

Installation and Operation Manual

# ***Vmux-2100***

## ***Voice Trunking Gateway***



# Vmux-2100

## Voice Trunking Gateway Installation and Operation Manual

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<b>International Headquarters</b> <b>RAD Data Communications Ltd.</b>	<b>U.S. Headquarters</b> <b>RAD Data Communications Inc.</b>
24 Raoul Wallenberg St. Tel Aviv 69719 Israel Tel: 972-3-6458181 Fax: 972-3-6498250 E-mail: <a href="mailto:rad@rad.co.il">rad@rad.co.il</a>	900 Corporate Drive Mahwah, NJ 07430 USA Tel: (201) 529-1100, Toll free: 1-800-444-7234 Fax: (201) 529-5777 E-mail: <a href="mailto:market@radusa.com">market@radusa.com</a>

# Limited Warranty

RAD warrants to DISTRIBUTOR that the hardware in the Vmux-2100 to be delivered hereunder shall be free of defects in material and workmanship under normal use and service for a period of twelve (12) months following the date of shipment to DISTRIBUTOR.

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This Agreement shall be construed and governed in accordance with the laws of the State of Israel.

# General Safety Instructions

The following instructions serve as a general guide for the safe installation and operation of telecommunications products. Additional instructions, if applicable, are included inside the manual.

## Safety Symbols



**Warning**

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**This symbol may appear on the equipment or in the text. It indicates potential safety hazards regarding product operation or maintenance to operator or service personnel.**

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**Danger of electric shock! Avoid any contact with the marked surface while the product is energized or connected to outdoor telecommunication lines.**

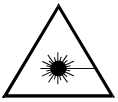
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**Protective earth: the marked lug or terminal should be connected to the building protective earth bus.**

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**Warning**

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**Some products may be equipped with a laser diode. In such cases, a label with the laser class and other warnings as applicable will be attached near the optical transmitter. The laser warning symbol may be also attached.**

**Please observe the following precautions:**

- **Before turning on the equipment, make sure that the fiber optic cable is intact and is connected to the transmitter.**
- **Do not attempt to adjust the laser drive current.**
- **Do not use broken or unterminated fiber-optic cables/connectors or look straight at the laser beam.**
- **The use of optical devices with the equipment will increase eye hazard.**
- **Use of controls, adjustments or performing procedures other than those specified herein, may result in hazardous radiation exposure.**

**ATTENTION: The laser beam may be invisible!**

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Always observe standard safety precautions during installation, operation and maintenance of this product. Only qualified and authorized service personnel should carry out adjustment, maintenance or repairs to this product. No installation, adjustment, maintenance or repairs should be performed by either the operator or the user.

# Handling Energized Products

## General Safety Practices

Do not touch or tamper with the power supply when the power cord is connected. Line voltages may be present inside certain products even when the power switch (if installed) is in the OFF position or a fuse is blown. For DC-powered products, although the voltages levels are usually not hazardous, energy hazards may still exist.

Before working on equipment connected to power lines or telecommunication lines, remove jewelry or any other metallic object that may come into contact with energized parts.

Unless otherwise specified, all products are intended to be grounded during normal use. Grounding is provided by connecting the mains plug to a wall socket with a protective earth terminal. If an earth lug is provided on the product, it should be connected to the protective earth at all times, by a wire with a diameter of 18 AWG or wider. Rack-mounted equipment should be mounted only in earthed racks and cabinets.

Always make the ground connection first and disconnect it last. Do not connect telecommunication cables to ungrounded equipment. Make sure that all other cables are disconnected before disconnecting the ground.

## Connection of AC Mains

Make sure that the electrical installation complies with local codes.

Always connect the AC plug to a wall socket with a protective ground.

The maximum permissible current capability of the branch distribution circuit that supplies power to the product is 16A. The circuit breaker in the building installation should have high breaking capacity and must operate at short-circuit current exceeding 35A.

Always connect the power cord first to the equipment and then to the wall socket. If a power switch is provided in the equipment, set it to the OFF position. If the power cord cannot be readily disconnected in case of emergency, make sure that a readily accessible circuit breaker or emergency switch is installed in the building installation.

## Connection of DC Mains

Unless otherwise specified in the manual, the DC input to the equipment is floating in reference to the ground. Any single pole can be externally grounded.

Due to the high current capability of DC mains systems, care should be taken when connecting the DC supply to avoid short-circuits and fire hazards.

DC units should be installed in a restricted access area, i.e. an area where access is authorized only to qualified service and maintenance personnel.

Make sure that the DC supply is electrically isolated from any AC source and that the installation complies with the local codes.

The maximum permissible current capability of the branch distribution circuit that supplies power to the product is 16A. The circuit breaker in the building installation should have high breaking capacity and must operate at short-circuit current exceeding 35A.

Before connecting the DC supply wires, ensure that power is removed from the DC circuit. Locate the circuit breaker of the panel board that services the equipment and switch it to the OFF position. When connecting the DC supply wires, first connect the ground wire to the corresponding terminal, then the positive pole and last the negative pole. Switch the circuit breaker back to the ON position.

A readily accessible disconnect device that is suitably rated and approved should be incorporated in the building installation.

# Connection of Data and Telecommunications Cables

Data and telecommunication interfaces are classified according to their safety status.

The following table lists the status of several standard interfaces. If the status of a given port differs from the standard one, a notice will be given in the manual.

Ports	Safety Status	
V.11, V.28, V.35, V.36, RS-530, X.21, 10 BaseT, 100 BaseT, Unbalanced E1, E2, E3, STM, DS-2, DS-3, S-Interface ISDN, Analog voice E&M	SELV	Safety Extra Low Voltage:  Ports which do not present a safety hazard. Usually up to 30 VAC or 60 VDC.
xDSL (without feeding voltage), Balanced E1, T1, Sub E1/T1	TNV-1	Telecommunication Network Voltage-1:  Ports whose normal operating voltage is within the limits of SELV, on which overvoltages from telecommunications networks are possible.
FXS (Foreign Exchange Subscriber)	TNV-2	Telecommunication Network Voltage-2:  Ports whose normal operating voltage exceeds the limits of SELV (usually up to 120 VDC or telephone ringing voltages), on which overvoltages from telecommunication networks are not possible. These ports are not permitted to be directly connected to external telephone and data lines.
FXO (Foreign Exchange Office), xDSL (with feeding voltage), U-Interface ISDN	TNV-3	Telecommunication Network Voltage-3:  Ports whose normal operating voltage exceeds the limits of SELV (usually up to 120 VDC or telephone ringing voltages), on which overvoltages from telecommunication networks are possible.

**Always connect a given port to a port of the same safety status. If in doubt, seek the assistance of a qualified safety engineer.**

Always make sure that the equipment is grounded before connecting telecommunication cables. Do not disconnect the ground connection before disconnecting all telecommunications cables.

Some SELV and non-SELV circuits use the same connectors. Use caution when connecting cables. Extra caution should be exercised during thunderstorms.

When using shielded or coaxial cables, verify that there is a good ground connection at both ends. The earthing and bonding of the ground connections should comply with the local codes.

The telecommunication wiring in the building may be damaged or present a fire hazard in case of contact between exposed external wires and the AC power lines. In order to reduce the risk, there are restrictions on the diameter of wires in the telecom cables, between the equipment and the mating connectors.

**Caution**

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To reduce the risk of fire, use only No. 26 AWG or larger telecommunication line cords.

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**Attention**

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Pour réduire les risques d'incendie, utiliser seulement des conducteurs de télécommunications 26 AWG ou de section supérieure.

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Some ports are suitable for connection to intra-building or non-exposed wiring or cabling only. In such cases, a notice will be given in the installation instructions.

Do not attempt to tamper with any carrier-provided equipment or connection hardware.

## Australian Safety Requirements

WARNING: THIS EQUIPMENT MUST ONLY BE INSTALLED AND MAINTAINED BY SERVICE PERSONNEL

In order to comply with Australian safety requirements for telecommunication equipment, observe the following safety instructions:

1. VMUX-M/M-ETH-E1 module:  
Remove JP7 and JP16 from the module circuit board.
2. VMUX-M/VC-E1/4 module:  
Connection of this module's ports to public telecommunication networks must be via a Line Isolation Unit with a telecommunication compliance label.

## Electromagnetic Compatibility (EMC)

The equipment is designed and approved to comply with the electromagnetic regulations of major regulatory bodies. The following instructions may enhance the performance of the equipment and will provide better protection against excessive emission and better immunity against disturbances.

A good earth connection is essential. When installing the equipment in a rack, make sure to remove all traces of paint from the mounting points. Use suitable lock-washers and torque. If an external grounding lug is provided, connect it to the earth bus using braided wire as short as possible.

The equipment is designed to comply with EMC requirements when connecting it with unshielded twisted pair (UTP) cables. However, the use of shielded wires is always recommended, especially for high-rate data. In some cases, when unshielded wires are used, ferrite cores should be installed on certain cables. In such cases, special instructions are provided in the manual.

Disconnect all wires which are not in permanent use, such as cables used for one-time configuration.

The compliance of the equipment with the regulations for conducted emission on the data lines is dependent on the cable quality. The emission is tested for UTP with 80 dB longitudinal conversion loss (LCL).

Unless otherwise specified or described in the manual, TNV-1 and TNV-3 ports provide secondary protection against surges on the data lines. Primary protectors should be provided in the building installation.

The equipment is designed to provide adequate protection against electro-static discharge (ESD). However, it is good working practice to use caution when connecting cables terminated with plastic connectors (without a grounded metal hood, such as flat cables) to sensitive data lines. Before connecting such cables, discharge yourself by touching earth ground or wear an ESD preventive wrist strap.



## FCC-15 User Information

This equipment has been tested and found to comply with the limits of the Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the Installation and Operation manual, may cause harmful interference to the radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

## Canadian Emission Requirements

This Class A digital apparatus meets all the requirements of the Canadian Interference-Causing Equipment Regulation.

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

## Warning per EN 55022 (CISPR-22) and AN/N45 3548

### ***Warning***

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This is a class A product. In a domestic environment, this product may cause radio interference, in which case the user will be required to take adequate measures.

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### ***Avertissement***

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Cet appareil est un appareil de Classe A. Dans un environnement résidentiel, cet appareil peut provoquer des brouillages radioélectriques. Dans ces cas, il peut être demandé à l'utilisateur de prendre les mesures appropriées.

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### ***Achtung***

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Dieses ist ein Gerät der Funkstörgrenzwertklasse A. In Wohnbereichen können bei Betrieb dieses Gerätes Rundfunkstörungen auftreten, in welchen Fällen der Benutzer für entsprechende Gegenmaßnahmen verantwortlich ist.

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# Declaration of Conformity

**Manufacturer's Name:** RAD Data Communications Ltd.

**Manufacturer's Address:** 24 Raoul Wallenberg St.  
Tel Aviv 69719  
Israel

**Declares that the product:**

**Product Name:** VMUX-2100

Conforms to the following standard(s) or other normative document(s):

<b>EMC:</b>	EN 55022:1994	Limits and methods of measurement of radio disturbance characteristics of information technology equipment.
	EN 50024:1998	Information technology equipment – Immunity characteristics – Limits and methods of measurement.
<b>Safety:</b>	EN 60950:2000	Safety of information technology equipment.

## Supplementary Information:

The product herewith complies with the requirements of the EMC Directive 89/336/EEC, the Low Voltage Directive 73/23/EEC and the R&TTE Directive 99/5/EC. The product was tested in a typical configuration.

Tel Aviv, 9<sup>th</sup> May, 2002



Haim Karshen  
VP Quality

**European Contact:** RAD Data Communications GmbH, Otto-Hahn-Str. 28-30,  
85521 Ottobrunn-Riemerling, Germany

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# Chapter 1

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## Introduction

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### 1.1 Overview

Vmux-2100 is a modular voice trunking gateway that enables up to 16 E1 or T1 circuits to be extended over a single E1, T1 or IP link. Vmux-2100 implements G.723.1, G.729 A, G.711 compression and TDMoIP multiplexing algorithms to send up to 480/384 voice channels over a single E1/T1 or IP link with transparent CAS and CCS support. Vmux-2100 utilizes voice activity detection, silence suppression, echo cancellation and other techniques to improve voice quality. The gateway detects, generates and relays DTMF/MFR2/MFC signaling. In addition, Vmux-2100 supports fax and data modem relay.

Vmux-2100 can be managed locally via an ASCII terminal or remotely via Telnet or RADview (RAD's SNMP-based network management application).

### Versions

Vmux-2100 includes voice and main link modules.

#### Voice Module

Voice module includes two or four balanced E1/T1 ports.

#### Main Link Module

A main link module supports the following interface combinations:

- Two E1 ports (balanced) with a UTP Ethernet port
- Two T1 ports (balanced) with a UTP Ethernet port
- A single Ethernet port.

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**Note** *Vmux-2100 supports unbalanced E1 interface by using an external RJ-45-to-BNC interface adapter, CBL-RJ45/2BNC.*

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## Applications

Figure 1-1 shows a Vmux-2100 application, where the gateway transmits compressed voice over an IP network, including transparent transmission of CCS and CAS signaling.

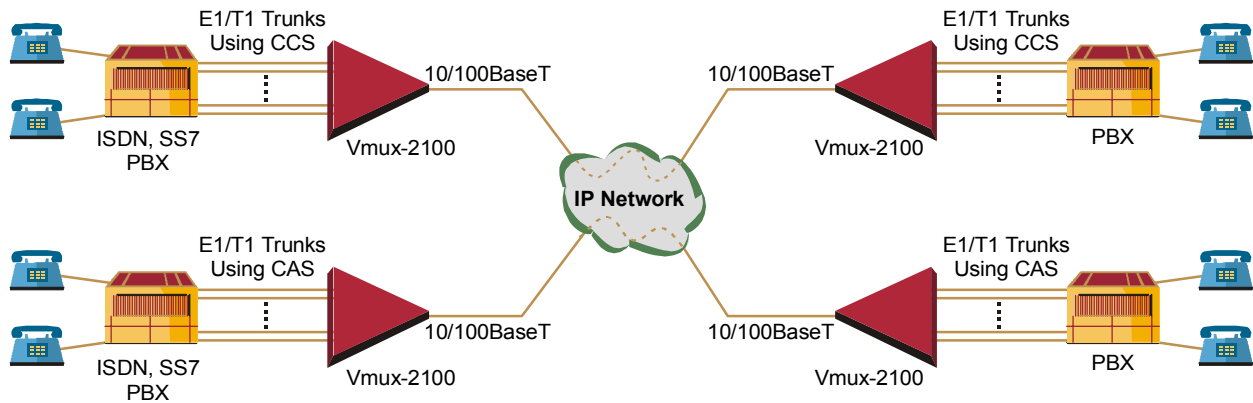


Figure 1-1. Transmitting Compressed Voice and Signaling over IP Network

Figure 1-2 illustrates a Vmux-2100 implementing 16:1 TDMoIP compression to transmit 480/384 voice channels over a single E1/T1 TDM link.

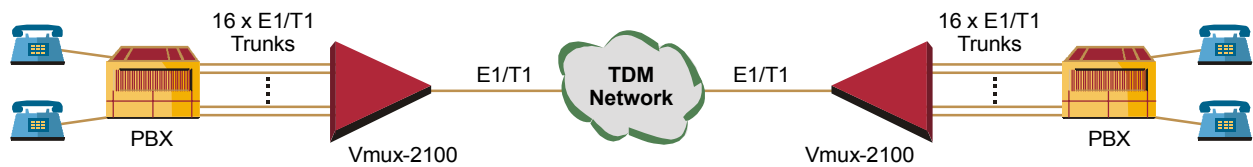


Figure 1-2. Transmitting 480/384 Voice Channels over a Single E1/T1 Link (16:1 Compression)

Figure 1-3 shows a central Vmux-2100 operating opposite three remote Vmux-2100 units in a point-to-multipoint application.

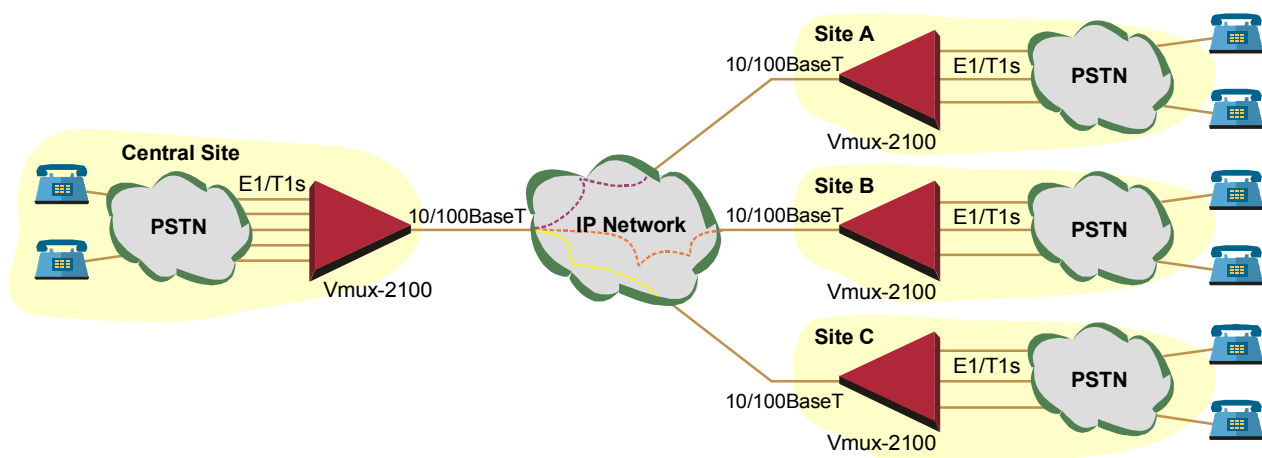


Figure 1-3. Transmitting Compressed Voice in Point-to-Multipoint Application

## Features

### E1 Main Link

Balanced redundant E1 main links ports use HDB3 coding and comply with G.703, G.704, G.706, G.732 and G.823 standards. The E1 framers support pass-through, G.732S and G.732N framing with or without CRC-4. Integral LTU/DSU can be enabled for line protection and long haul options. Unbalanced E1 connection is achieved via an external interface adapter.

### T1 Main Link

Balanced redundant T1 main link ports use AMI coding, B8ZS zero suppression, and comply with ANSI T1.403, AT&T TR-62411 and ITU-T G.703 standards. The T1 framers support pass-through, SF, ESF. Integral DSU/CSU can be enabled for line protection and long haul options.

### Ethernet Main Link

Vmux-2100 has a half/full duplex, 10/100BaseT Ethernet port with autonegotiation support. If autonegotiation is disabled, Vmux-2100 can be configured to any of the following:

- 10BaseT – half or full duplex
- 100BaseT – half or full duplex.

The main link Ethernet port supports direct and indirect connection to the IP networks.

### Voice Modules

Vmux-2100 voice modules control E1/T1 frames, use G.723.1 (6.4 or 5.3 kbps), G.729 A (8 kbps) and G.711 compression algorithms, and handle CAS/CCS signaling transparently. Every group of two E1s or T1s is assigned a separate IP address.

Voice Activity Detection mechanism allows optimizing bandwidth utilization, as Vmux-2100 generates traffic only when voice activity is detected. Vmux-2100 uses the G.723.1 A and G.729 B techniques for silence suppression and the G.168 standard for echo cancellation (up to 16 ms per channel). Vmux-2100 detects, generates and relays DTMF/MFR2/MFC signals. In addition, Vmux-2100 supports Group III fax relay (4.8, 9.6, 14.4 kbps) and transmits voice-band modem data.

Voice modules are hot-swappable.

### TDMoIP Multiplexing

Vmux-2100 encapsulates the payload bytes in a UDP frame that is transferred over IP and over Ethernet.

The number of TDM bytes in a multiplexed frame and packetizing interval are user-configurable.

A destination IP address can be configured for each bundle (see *Bundling*, below).

## Bundling

Bundle is a logical internal port of Vmux-2100, containing up to 60 timeslots. Each E1/T1 group handles up to five bundles. A bundle is routed to a defined remote IP address (remote group address). Each timeslot can be included in any bundle belonging to its E1/T1 group. At the remote site, it can be connected to any timeslot within a destination bundle.

Bundle QoS support:

- Labeling IP level priority (ToS).
- VLAN tagging and priority labeling according to IEEE 802.1 p&q.

The user can configure the ToS (Type of Service) of the outgoing IP packets. This allows an en-route layer 3 router or switch, which supports ToS, to give higher priority to Vmux-2100 traffic for delay-sensitive and secure applications. Vmux-2100 allows you to configure the whole ToS byte field, since different vendors may use different bits to tag packets for traffic prioritization. This also enables you to work according to various RFC definitions (for example RFC 2474, RFC 791).

## Timing

Available timing modes are:

- **Loopback** – The E1 or T1 transmit clock is derived from the E1/T1 receive clock.
- **Internal** – Vmux-2100 features a separate internal oscillator for each voice card. When a voice module is configured to operate in internal clock, transmit (Tx) and receive (Rx) trunks use the clock supplied by its internal oscillator.

## Diagnostics

Vmux-2100 supports local (internal) and remote (external) loopback activation on E1/T1 links. The user can also perform tone injection towards the local PBX. In addition, a ping utility is included to confirm IP connectivity to the remote units.

## Statistics Collection

Vmux-2100 provides extensive statistics collection capabilities which include: Ethernet (as per RFC 1643) and HDLC statistics, voice, signaling, bundles, CPU and memory utilization.

## Management

Vmux-2100 can be managed via a local terminal, Telnet or RADview, RAD's network management system. Vmux-2100 has a DB-9 female port for the direct terminal connection. Alternatively, a supervisory terminal can be connected via a modem link.

Software upload and download and configuration can be performed via the local terminal, TFTP or via RADview. Remote units are managed via Telnet over an inband management link running on an E1/T1 link.

Vmux-2100 supports a four-level security and user-authentication system:

- **Administrator** – Allowed to configure all the parameters of Vmux-2100.
- **Operator** – Allowed to perform all operations in the system except for user administration (adding/deleting users, changing user definitions).
- **Technician** – Allowed to test Vmux-2100 and monitor its operation (for example, monitoring alarms).
- **Monitor** – Allowed to monitor the Vmux-2100 operation.

When Vmux-2100 is managed over Telnet, up to five simultaneous management sessions are allowed. Access to the Vmux-2100 software can be limited to the ASCII terminal and RADview management by disabling the Telnet access.

## Power

Vmux-2100 can be ordered with dual redundant hot-swappable power supplies, supporting load sharing.

- AC: 100 to 240 VAC
- DC: 30 to 70 VDC (48 VDC, nominal).

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## 1.2 Physical Description

Vmux-2100 is a 1U high, easy-to-install standalone device. [Figure 1-4](#) illustrates a 3-D view of the unit.



*Figure 1-4. Vmux-2100, 3-D View*

The front panel includes LEDs which indicate power supply, alarm and test diagnostic status. The front panel indicators are described in [Chapter 3](#).

The rear panel includes E1/T1 voice ports, DB-9 control port, Ethernet and E1/T1 main link connectors. These are described in [Chapter 2](#).

## 1.3 Functional Description

Figure 1-5 illustrates the block diagram of Vmux-2100.

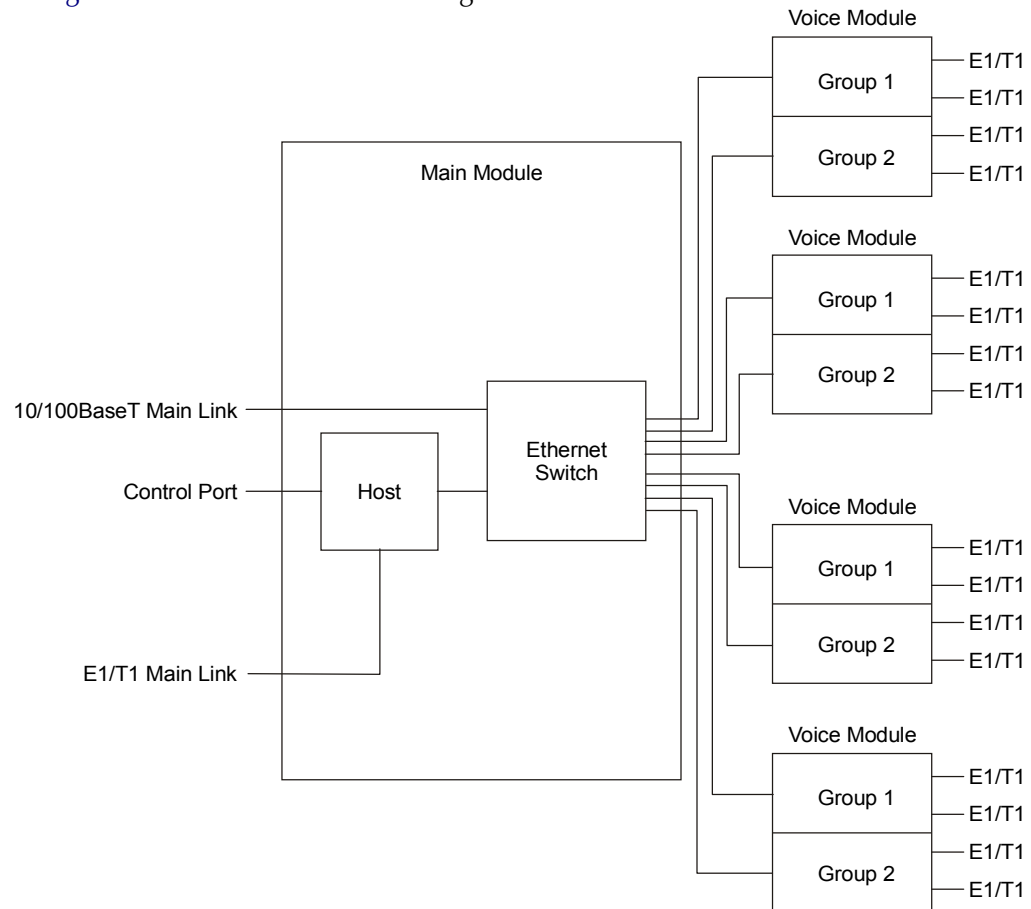


Figure 1-5. Vmux-2100 Block Diagram

### Voice Modules

Voice modules include two or four E1/T1 ports which receive E1/T1 trunks from PBXs. Every two E1 and T1 ports are referred to as a *group*, which receives a separate IP address.

### Signaling

Signaling information is processed according to signaling mode: CAS for E1, Robbed Bit MF for T1, or CCS for E1 and T1.

- CAS/Robbed Bit MF** – The signaling data is processed by a separate DSP by extracting the ABCD bits and reporting any change in their status to the host. The reporting format is similar to E1, T1 ESF and T1 SF. In addition, the signaling DSP employs a refresh mechanism to update the host with the most recent status of the ABCD bits. The ABCD bits can be manipulated by using translation rules, which are defined by means of signaling profiles.

A profile enables the user to select the translation of each individual signal bit. The available selections are A, B, C, D (value copied from the corresponding incoming bit), NOT A, NOT B, NOT C, NOT D (inverted value of corresponding incoming bit), 0 (always 0), and 1 (always 1).

In addition to the translation of individual bits, the signaling profiles can also be used to define the signaling bit patterns that indicate the idle and OOS states.

- **CCS** – The signaling information is transferred transparently to the host, which encapsulates the HDLC frame with the proper IP header and sends it to the main link. The following protocols are supported: ISDN, QSIG and SS7. HDLC data can be extracted from any set of timeslots and sent to a single destination. When operating with SS7 signaling, it is possible to control amount of the keep-alive bits transferred over the signaling links.

## Compression

The DSPs handle the voice traffic by compressing it according to G.723.1 (6.4 or 5.3 kbps) and G.729 A (8 kbps), or digitizes it according to the G.711 requirements (A-law and  $\mu$ -law). Compression methods are user-selectable per bundle.

## Voice Activity Detection

Voice Activity Detection (VAD) uses digital signal processing techniques to distinguish between silence and speech on a voice connection. VAD reduces the bandwidth requirements of a voice connection by generating traffic only during periods of active voice conversation. With Comfort Noise Generation supported at the remote site, VAD significantly reduces bandwidth consumption without degrading voice quality. VAD achieves additional bandwidth savings when combined with voice compression techniques.

## TDMoIP Multiplexing

Compressed voice payload is multiplexed by using the TDMoIP technique. The multiplexing is performed by the Vmux-2100 software. The DSPs send a continuous stream of voice packets; which are put together into a TDMoIP frame by adding AAL2 headers and a TDMoIP header. [Figure 1-6](#) illustrates the TDMoIP frame structure.

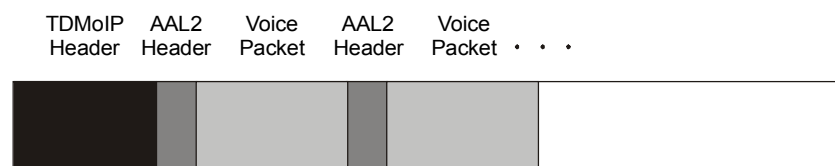


Figure 1-6. TDMoIP Frame Structure

The size of TDMoIP frame is determined by the following parameters:

- Packetizing interval – Defining time interval allocated for the TDMoIP frame aggregation (10 to 90 msec).
- Maximum bytes per multiplexed frame – Specifying the maximum size of each frame (100 to 1461 bytes).

## Ethernet Frame

At a later stage, the TDMoIP frame becomes a part of the standard Ethernet frame, which also includes a UDP header, IP header and MAC. The Ethernet frames are forwarded to the Ethernet switch, which sends them to one of the main links: 10/100BaseT or E1/T1. [Figure 1-7](#) illustrates the structure of the Vmux-2100 Ethernet frame. [Table 1-1](#) describes the fields of the Vmux-2100 Ethernet frame.

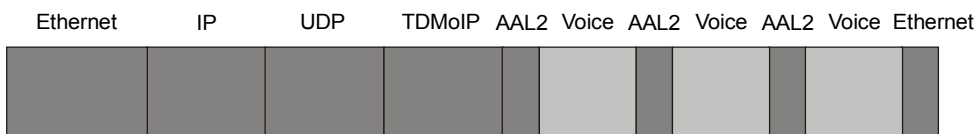


Figure 1-7. Ethernet Frame Structure

Table 1-1. Ethernet Frame Fields

	Field Length (bytes)	Field	
MAC Layer	7	Preamble	
	1	SFD	
	6	Destination MAC Address	
	6	Source MAC Address	
LLC Layer	2	Type	← IEEE 802.1p&q VLAN Tagging (additional 4 bytes if enabled)
	1	Vers/HLEN	
	1	Service Type	
	2	Total Length	
IP Layer	2	Identification	
	1	Flags/Fragment Offset (most)	
	1	Fragment Offset (least)	
	1	Time to Live	
	1	Protocol	
	2	Header Checksum	
	4	Source IP Address	
	4	Destination IP Address	
	2	UDP Source Port	← <b>Note:</b> The UDP source port field is used to transfer a destination bundle number.
	2	UDP Destination Port	
UDP Layer	2	UDP Message Length	
	2	UDP Checksum	
Data Layer	...	Payload	
MAC Layer	4	CRC	



## VLAN Support

Vmux-2100 supports VLAN, according to IEEE 802.1p&q. When VLAN support is enabled Vmux-2100 adds four bytes to the MAC layer of the Ethernet frame. The content of these bytes, MAC layer priority and VLAN ID, can be set by the user. In this mode, only VLAN format frames are sent and received by Vmux-2100. The following figure describes the VLAN tag format.

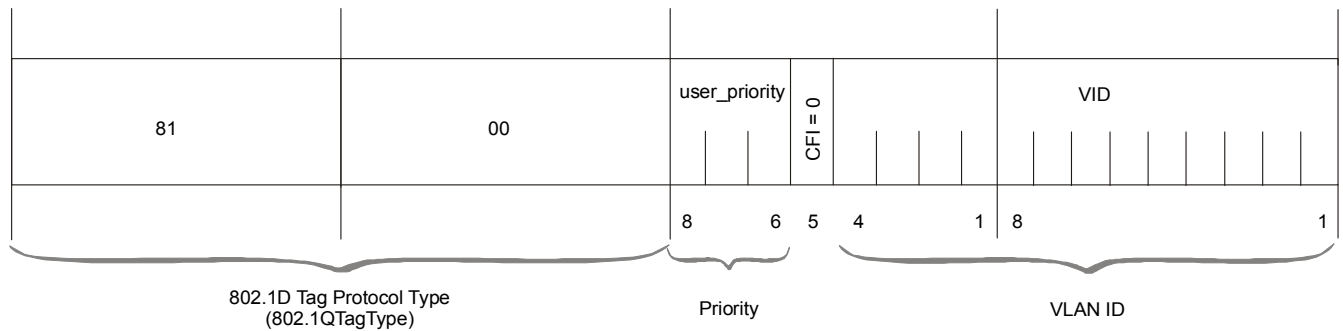


Figure 1-8. VLAN Tag Format

## UDP Support

Table 1-2. UDP Source Port as Destination Voice Port

Field Length (Bits)	Field Description	Value
2 bytes	UDP Source Port*	2 – 497d
2 bytes	UDP Destination Port	2142d

\* – The MSB of this field can be either 1 or 0 for inband end-to-end proprietary signaling.

**Note** The UDP Source Port field is used for destination voice bundle indication. For example, if the destination is:  
Bundle 1 – 02, Bundle 2 – 03, Bundle 3 – 04, Bundle 4 – 05, etc.

For more information about VLAN tagging, see IEEE Std 802.1 p&q.

## Ethernet Main Link

10/100BaseT main link receives Ethernet frames from the voice modules via the Ethernet switch and forwards them to the remote device over the IP network. The 10/100BaseT main link of Vmux-2100 supports full duplex transmission with autonegotiation and half duplex with the backpressure option.

## E1/T1 Main Link

When using E1/T1 main link, Vmux-2100 adds HDLC flags to the Ethernet frames and transmits them over a TDM network. The E1/T1 main link interface of Vmux-2100 is fully redundant. When both of links are configured as active, Vmux-2100 starts sending data over the one that was connected first. If a loss of synchronization is detected on an active link, Vmux-2100 automatically switches to the backup link.

The E1/T1 links operate with loopback timing by deriving clock from the device connected to its E1/T1 port or with internal clock provided by the Vmux-2100 internal oscillator.

## Bandwidth Utilization

By using TDMoIP multiplexing and the voice activity detection, Vmux-2100 supports a higher number of voice channels over TDM than it is possible by utilizing conventional compression methods alone. TDMoIP multiplexing and grouping the timeslots of compressed voice together into bundles with a common IP address reduces the actual bandwidth used per channel to as low as 4 kbps (16:1), when all channels are active. Better compression, up to 20:1, is achieved when some of the voice channels are idle.

The actual bandwidth utilization is determined by the following factors:

- Header sizes:
  - Ethernet – 18 bytes
  - IP – 20 bytes
  - UDP – 8 bytes
  - TDMoIP – 4 bytes
  - VLAN (if exists) – 4 bytes.
- Size of the voice packet:
  - G.723 – 24 bytes + AAL2 header (3 bytes) + voice payload (4 bytes)
  - G.729 – 10 bytes + AAL2 header (3 bytes) + voice payload (4 bytes).
- Packet interval:
  - G.723.1 – 30 msec
  - G.729 – 10 msec.
- Number of timeslots in a bundle
- Silence percentage. Studies show that an average person speaks only 40% of the time during a telephone conversation. 50% of the time is spent listening to the other party, while the remaining 10% is spent quietly contemplating.
- Connectivity packets – 64 bytes per minute.

### Calculating Approximate Bandwidth Utilization

Let us calculate an approximate bandwidth for 30 timeslots in one bundle with G.723.1 (6.4 kbps) compression, 60 % of silence:

$$\left[ \frac{[(50 \times 1000/40) + (30 \times 31 \times 1000/30 \times 0.4)] \times 8}{1000} \right] + 0.00853 = 109.208 \text{ kbps}$$

where:

- 50 – size of Ethernet, IP, UDP, TDMoIP headers
- 1000/40 – packets per second (pps) transmission rate, calculated according to the packetizing interval chosen (40 msec in this example)
- 30 – number of timeslots
- 31 – size of the compressed G.732 packet plus AAL2 header and voice payload
- 0.4 – 60% of silence
- 8 – conversion from bytes to bits
- 1000 in the denominator – conversion from bits to kilobits
- 0.00853 – connectivity packets rate (64 bytes per minute) converted to kbps.

## 1.4 Technical Specifications

<b>Ethernet Main Link</b>	<i>Standards</i>	IEEE 802.3, 802.3u, Ethernet 802.1p/q
	<i>Data Rate</i>	10 or 100 Mbps, half duplex or full duplex, autonegotiation support
	<i>Statistics</i>	According to RFC 1643 or RFC 2665: <ul style="list-style-type: none"> <li>• <b>Received frames</b> – Correct Frames, Correct Octets, Alignment Errors, FCS Errors</li> <li>• <b>Transmitted frames</b> – Correct Frames, Correct Octets, Single Collision, Multiple Collision, Deferred Transmission, Late Collision, Carrier Sense Error</li> </ul>
	<i>Range</i>	Copper: <ul style="list-style-type: none"> <li>• Up to 100m (328 feet) over UTP Cat.5 cable</li> </ul> Fiber optic: <ul style="list-style-type: none"> <li>• 20 km (12 miles) over single-mode cable, 1310 nm</li> <li>• 2 km (1.2 mile) over multimode cable, 1310 nm</li> </ul>
	<i>Connector</i>	Copper: RJ-45, 8-pin Fiber optic: LC
<b>E1 Main Link</b>	<i>Number of Links</i>	Two (one redundant)
	<i>Data Rate</i>	2.048 Mbps
	<i>Standards</i>	ITU-T Rec. G.703, G.704, G.706, G.732, G.823
	<i>Framing</i>	G.732S and G.732N with or without CRC-4, in compliance with ITU-T Rec. G.703, G.704, G.732 requirements
	<i>Line Code</i>	HDB3
	<i>Receive Signal Level</i>	0 to -43 dB with LTU 0 to -12 dB without LTU
	<i>Transmit Signal Level</i>	Balanced: $\pm 3V$ ( $\pm 10\%$ ) Unbalanced: $\pm 2.37V$ ( $\pm 10\%$ )
	<i>Jitter Performance</i>	Per ITU-T G.823
	<i>Timing</i>	Internal or loopback
	<i>Line Impedance</i>	120 $\Omega$ , balanced 75 $\Omega$ , unbalanced
	<i>Connector</i>	Balanced: RJ-45, 8-pin Unbalanced: via CBL-RJ45/2BNC interface adapter

<b>T1 Main Link</b>	<i>Number of Links</i>	Two (one redundant)
	<i>Data Rate</i>	1.544 Mbps
	<i>Standards</i>	ANSI T1.403, AT&T TR-62411, ITU-T Rec. G.703
	<i>Line Code</i>	AMI
	<i>Zero Suppression</i>	B8ZS
	<i>Framing</i>	SF, ESF, transparent
	<i>Timing</i>	Internal or loopback
	<i>Statistics</i>	Full statistical diagnostics capability according to ANSI T1.403-1989 Local support of ESF diagnostics according to AT&T PUB 54016
	<i>Receive Signal Level</i>	0 to -36 dB with CSU 0 to -30 dB without CSU
	<i>Transmit Signal Level</i>	0, -7.5, -15, or -22.5 dB with CSU $\pm 2.7V$ ( $\pm 10\%$ ) at 0–655 ft without CSU
	<i>Jitter Performance</i>	Per AT&T TR-62411
	<i>Line Impedance</i>	100 $\Omega$ , balanced
<b>E1 Voice Ports</b>	<i>Ports per Module</i>	Two or four
	<i>Data Rate</i>	2.048 Mbps per port
	<i>Standards</i>	ITU-T Rec. G.703, G.704, G.706, G.732, G.823
	<i>Framing</i>	G.732S and G.732N with or without CRC-4, in compliance with ITU-T Rec. G.703, G.704, G.732 requirements
	<i>Line Code</i>	HDB3
	<i>Receive Signal Level</i>	0 to -43 dB with LTU 0 to -12 dB without LTU
	<i>Transmit Signal Level</i>	$\pm 3V$ ( $\pm 10\%$ )
	<i>Jitter Performance</i>	Per ITU-T G.823
	<i>Line Impedance</i>	120 $\Omega$ , balanced
	<i>Connector (per port)</i>	RJ-45, 8-pin
<b>T1 Voice Ports</b>	<i>Ports per Module</i>	Two or four
	<i>Data Rate</i>	1.544 Mbps per port
	<i>Standards</i>	ANSI T1.403, ITU-T Rec. G.703

	<i>Line Code</i>	<i>AMI</i>
	<i>Zero Suppression</i>	<i>B8ZS</i>
	<i>Framing</i>	<i>D4, ESF</i>
	<i>Receive Signal Level</i>	<i>0 to -36 dB with CSU</i> <i>0 to -30 dB without CSU</i>
	<i>Transmit Signal Level</i>	<i>0, -7.5, -15, or -22.5 dB with CSU</i> <i>±2.7V (±10%) at 0–655 ft without CSU</i>
	<i>Jitter Performance</i>	<i>Per AT&amp;T TR-62411, G.824</i>
	<i>Line Impedance</i>	<i>100Ω, balanced</i>
	<i>Connector (per port)</i>	<i>RJ-45, 8-pin</i>
<b>Voice Processing</b>	<i>Compression Algorithms</i>	<i>G.723.1 (5.3 or 6.4 kbps), G.729 A (8 kbps), G.711 (a-law/μ-law)</i>
	<i>Silence Suppression</i>	<i>G.723.1A, G.729B</i>
	<i>Echo Cancellation</i>	<i>16 ms per channel as per G.168</i>
	<i>Fax Relay</i>	<i>Group III: 4.8, 9.6, 14.4 kbps</i>
	<i>Voice-Band Modem</i>	<i>Transparent transfer</i>
	<i>MF Signaling Support</i>	<i>DTMF, MFR2, MFC detection, generation and relay</i>
<b>Control Port</b>	<i>Standard</i>	<i>V.24/RS-232 (DCE)</i>
	<i>Data Rate</i>	<i>9.6, 19.2, 38.4 or 57.6 kbps</i>
	<i>Connector</i>	<i>DB-9, female</i>
<b>Diagnostics</b>	<i>Tests</i>	<i>Local and remote loopbacks, tone injection towards the local PBX, ping utility</i>
	<i>Statistics Collection</i>	Main link module: <ul style="list-style-type: none"> <li>• Ethernet (as per RFC 1643)</li> <li>• CPU utilization</li> </ul> Voice modules: <ul style="list-style-type: none"> <li>• Ethernet</li> <li>• CPU utilization</li> <li>• HDLC</li> <li>• Bundles</li> <li>• Voice</li> <li>• Voice Rx and Tx signaling</li> <li>• Memory utilization</li> </ul>

<b>Indicators</b>	<i>Ethernet Main Link</i>	ACT (yellow), blinks according to the Ethernet traffic LINK (green), ON – Good link integrity
	<i>E1 Main Link and Voice Port</i>	LOC (red), ON – Local sync loss occurred REM (red), ON – Remote sync loss occurred
	<i>T1 Main Link and Voice Port</i>	RED (red), ON – Red alarm is received YEL (red), ON – Yellow alarm is received
	<i>General</i>	PWR1 (green), ON – Power supply 1 is on PWR2 (green), ON – Power supply 2 is on ALM (red), ON – An alarm is present in the system TST (yellow), ON – A test is active POWER (green), ON – Power supply is on POWER (red), ON – Power supply is off
<b>Power Supply</b>	<i>Number</i>	Two, redundant, hot-swappable
	<i>AC Source</i>	100 to 240 VAC, 50 or 60 Hz, 40W
	<i>DC Source</i>	-36 to -72 VDC (-48 VDC, nominal)
<b>Physical</b>	<i>Height</i>	4.3 cm / 1.7 in (1U)
	<i>Width</i>	43.5 cm / 17.1 in
	<i>Depth</i>	24.0 cm / 9.5 in
	<i>Weight</i>	7.0 kg / 15.5 lb
<b>Environment</b>	<i>Operating Temperature</i>	0 to 50°C / 32 to 122°F
	<i>Storage Temperature</i>	-20 to 70°C / -4 to 158°F
	<i>Humidity</i>	Up to 90%, non-condensing

# Chapter 2

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## Installation and Setup

This chapter describes installation and setup procedures for the Vmux-2100 device.

After installing the unit:

- Refer to [Chapter 3](#) for the operating instructions.
- Refer to [Chapter 4](#) for the detailed system configuration procedures using an ASCII terminal connected to the Vmux-2100 control port.

If a problem is encountered, refer to [Chapter 5](#) for test and diagnostic instructions.



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**Internal settings, adjustment, maintenance, and repairs may be performed only by a skilled technician who is aware of the hazards involved.**

**Always observe standard safety precautions during installation, operation, and maintenance of this product.**

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### 2.1 Site Requirements and Prerequisites

AC-powered Vmux-2100 units should be installed within 1.5m (5 ft) of an easily-accessible grounded AC outlet capable of furnishing the voltage in accordance with Vmux-2100 nominal supply voltage.

DC-powered Vmux-2100 unit requires a -48 VDC power source, which must be adequately isolated from the main supply.

The trunk circuit which supplies power to the unit must be protected by a circuit breaker of 16A maximum.

Allow at least 90 cm (36 in) of frontal clearance for operating and maintenance accessibility. Allow at least 10 cm (4 in) clearance at the rear of the unit for signal lines and interface cables.

The ambient operating temperature of Vmux-2100 is 0 to 50°C (32 to 122°F), at a relative humidity of up to 90%, non-condensing.

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## 2.2 Package Contents

The Vmux-2100 package includes the following items:

- One Vmux-2100 unit
- Vmux-2100 installation and operation manual
- CBL-RJ45/2BNC, RJ-45 to BNC interface adapter (if ordered)
- CBL-VMUX-MM-MODEM cross cable (if ordered)
- AC power cord or DC power supply connector kit.

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## 2.3 Installation and Setup

The Vmux-2100 unit is designed for desktop or bench installation and is delivered as a fully assembled unit. No provisions are made for bolting the unit to a tabletop.

► **To install Vmux-2100:**

1. Determine the required configuration of Vmux-2100, in accordance with your application.
2. Set the E1 main link board internal jumpers to match E1 connection type: balanced or unbalanced.
3. Connect the E1/T1 voice port.
4. Connect the 10/100BaseT or E1/T1 main link.
5. Connect an ASCII terminal or a PC running a terminal emulation software.
6. Connect power to the unit.

### Setting the Main Link E1 Internal Jumpers

When using the E1 main link, set the E1 main link board internal jumpers to match the E1 connection type: balanced or unbalanced. In addition, you can connect pin 3 and pin 6 of the RJ-45 E1 main link connector to the frame ground.

► **To set the E1 main link board jumpers:**

1. Disconnect all power and interface cables from Vmux-2100.
2. Release the two main link rear panel screws.
3. Slide the main link board interior out of the unit.
4. Set the E1 main link jumpers (see [Figure 2-1](#) and [Table 2-1](#)).



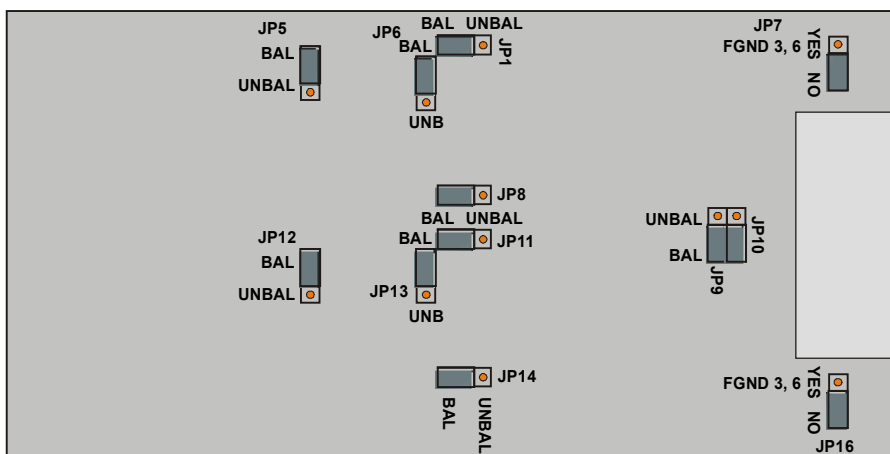


Figure 2-1. E1 Main Link Jumper Locations

Table 2-1. E1 Main Link Jumper Settings

Jumper	Description	Values	Factory Setting
E1 interface type jumpers, JP1, JP2, JP5, JP6, JP8, JP9, JP10, JP11, JP12, JP13, JP14, JP15	Select the E1 interface type: balanced or unbalanced.  <i>All the jumpers must be set to the same position (balanced or unbalanced).</i>	<b>BAL</b> – E1 balanced interface <b>UNBAL</b> – E1 unbalanced interface	BAL
Shield ground reference jumpers, JP16 (port A), JP7 (port B)	Control connection between the E1 cable shield (pin 3 and pin 6) and the frame ground.	<b>YES</b> – Shields are connected to the frame ground (in compliance with ITU-T I.431 requirements)  <b>NO</b> – Shields are not connected to the frame ground	NO

## Connecting the Interfaces

Figure 2-2 shows the rear panel of an AC-powered Vmux-2100 unit.

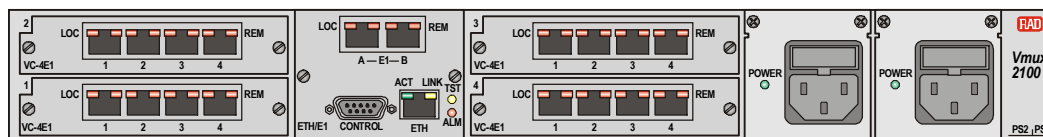


Figure 2-2. Vmux-2100 Rear Panel

### Connecting the E1/T1 Voice Ports

Each E1/T1 voice port terminates in RJ-45 balanced connector. [Appendix A](#) specifies the pinout of the E1 connector.

#### ► To connect the E1/T1 voice port:

- Connect the incoming E1/T1 link to the RJ-45 connector of the Vmux-2100 voice module, designated 1, 2, 3 or 4.

## Connecting the Main Link

The Vmux-2100 Ethernet main link interface terminates in an 8-pin RJ-45 connector. [Appendix A](#) specifies the pinout of the Ethernet connector. The Ethernet main link port supports connection via straight and cross cables.

➤ **To connect the Ethernet main link:**

- Connect the LAN to the RJ-45 connector designated ETH.

The E1/T1 main link interface terminates in an 8-pin RJ-45 balanced connector. [Appendix A](#) specifies the pinout of the E1/T1 balanced connector.

➤ **To connect the balanced E1/T1 main link:**

- Connect the E1/T1 link to the RJ-45 connector designated E1 A or E1 B.

➤ **To connect the unbalanced E1 main link:**

1. Insert the RJ-45 plug of the CBL-RJ45/2BNC adapter into the Vmux-2100 RJ-45 connector designated E1 A or E1 B.
2. Connect the coax cable to the BNC connectors of the CBL-RJ45/2BNC adapter.

## Connecting the ASCII Terminal

The Vmux-2100 control port terminates in a 9-pin D-type female interface connector. [Appendix A](#) specifies the pinout of the control port connector.

➤ **To connect the ASCII terminal directly to the CONTROL port:**

1. Connect the standard DB-9 flat cable to the 9-pin connector, designated CONTROL.
2. Connect the other side of the cable to the ASCII terminal.

➤ **To connect the ASCII terminal via modem link:**

1. Connect the VMUX connector of the CBL-VMUX-MM-MODEM cross cable to the CONTROL port (see [Appendix A](#) for the cable wiring diagram).
2. Connect the MODEM connector of the cross cable to the local modem.
3. Connect the remote modem to the ASCII terminal.

## Connecting the Power

Vmux-2100 includes two hot-swappable AC or DC power supplies, supporting load sharing. To connect Vmux-2100 to the power source, refer to the appropriate section below, depending on your version of the unit (AC or DC).



---

**Before switching on this unit and connecting or disconnecting any other cable, the protective earth terminals of this unit must be connected to the protective ground conductor of the mains (AC or DC) power cord. If you are using an extension cord (power cable) make sure it is grounded as well.**

**Any interruption of the protective (grounding) conductor (inside or outside the instrument) or disconnecting of the protective earth terminal can make this unit dangerous. Intentional interruption is prohibited.**

**The line fuse is located in an integral-type fuse holder located on the rear panel. Make sure that only fuses of the required rating, as marked on the rear panel, are used for replacement. Do not use repaired fuses or short-circuit the fuse holder. Always disconnect the mains cable before removing or replacing the fuse. Whenever it is likely that the fuse protection has been damaged, make the unit inoperative and secure it against unintended operation.**

---

### Connecting AC Power

AC power is supplied to Vmux-2100 through a standard 3-prong plug with an integral fuse holder (see [Figure 2-2](#)).

AC power should be supplied through the 5 ft (1.5m) standard power cable terminated by a standard 3-prong plug. The cable is provided with the unit.

➤ **To connect AC power:**

1. Connect the power cable(s) to the power connector(s) on the Vmux-2100 rear panel.
2. Connect the power cable to the mains outlet.

The unit will be turned on automatically upon connection to the mains.

### Connecting DC Power

➤ **To connect DC power:**

- Refer to [DC Power Supply Connection Supplement](#).



# Chapter 3

## Operation

This chapter provides the following information for Vmux-2100:

- Vmux-2100 front-panel indicators
- Operating procedures (turn-on, front-panel indications, performance monitoring and turn-off).

Installation procedures given in [Chapter 2](#) must be completed and checked before attempting to operate Vmux-2100.

### 3.1 Front Panel Indicators

The front panel of Vmux-2100 includes a series of LED indicators that show the current operating status of the unit (see [Figure 3-1](#)). Additional indicators are located on the rear panel, as shown in [Figure 3-2](#). [Table 3-1](#) lists and describes the Vmux-2100 indicators.



Figure 3-1. Vmux-2100, Front Panel

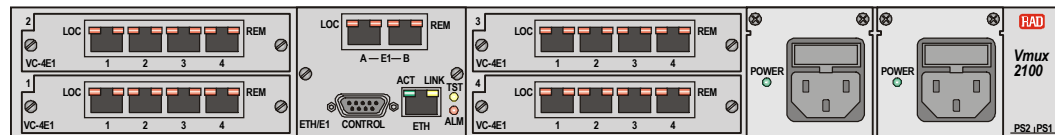


Figure 3-2. Vmux-2100, Rear Panel

Table 3-1. Vmux-2100 LEDs

Name	Function	Location
TST (yellow)	ON – A test is active	Front panel and main link module
ALM (red)	ON – Alarm is present	Front panel and main link module
PWR1 (green)	ON – Power supply 1 is ON	Front panel
PWR2 (green)	ON – Power supply 2 is ON	Front panel
POWER	ON (green) – A power supply is ON ON (red) – A power supply is OFF	Power supply module

Table 3-1. Vmux-2100 LEDs (Cont.)

Name	Function	Location
LINK (green)	ON – Good link integrity	Ethernet main link connector
ACT (yellow)	Blinks according to the Ethernet traffic	Ethernet main link connector
LOC (red)	ON – Local sync loss occurred	E1 main link and voice port connector
REM (red)	ON – Remote sync loss occurred	E1 main link and voice port connector
RED (red)	ON – Red alarm is received	T1 main link and voice port connector
YEL (yellow)	ON – Yellow alarm is received	T1 main link and voice port connector

## 3.2 Operating Vmux-2100

### Turning On Vmux-2100

➤ **To turn on Vmux-2100:**

- Connect the power cord(s) to the mains.

The PWR1(2) indicator lights up and remains lit as long as Vmux-2100 receives power.

### Normal Indications

[Table 3-2](#) shows the correct status of the indicators a few seconds after power-up.

Table 3-2. Vmux-2100 Indicator Status

Indicator	Status
PWR1/PWR2	On
TEST	Off
ALM	On
L	Off
R	Off

If the above LED indications do not appear following initial power turn-on, refer to [Chapter 5](#) for the diagnostic test instructions.

### Turning Off Vmux-2100

➤ **To turn off Vmux-2100:**

- Remove the power cord from the power source.

### 3.3 Default Settings

Vmux-2100 is managed by an ASCII terminal or PC running a terminal emulation program via menu-driven embedded software. [Table 3-3](#) lists the default settings of the Vmux-2100 configuration parameters.

Table 3-3. Vmux-2100 Default Settings

Parameter	Default Value				
System					
Set Host IP address	0.0.0.0				
Set Subnet Mask	0.0.0.0				
Set Default Gateway	0.0.0.0				
Trap	public				
Read	public				
Write	private				
Managers list	0.0.0.0				
Telnet	Enable				
Set Baud Rate	9600				
Timeout	3				
Dial-In Modem	Disable				
Signaling Profile		A	B	C	D
	Idle	1	0	0	0
	OOS	1	0	0	0
SS7 Keep-Alive Suppression Rate	0% - No Suppression / Not SS7				
Hub					
Slot 1	NO CARD				
Slot 2	NO CARD				
Slot 3	NO CARD				
Slot 4	NO CARD				
Main Link (Lan Parameters)					
Set Auto Negotiation	Enable				
Set Max Capability	100BaseT full duplex				
Main Link (E1 Parameters)					
Connect	No				
Frame	732S				
Restoration Time	1 second				
Clock Source	Lbt				
Interface Type	Ltu				
Idle Code	ff				

Table 3-3. Vmux-2100 Default Settings (Cont.)

Parameter	Default Value
<b>Main Link (T1 Parameters)</b>	
Connect	No
Clock Source	Lbt
Frame	Esf
Interface Type	Dsu
Line Code	B8ZS
Rx Sensitivity (CSU mode only)	LOW (-30 dB)
Tx Gain Level (CSU mode only)	0 dBm
Line Length (DSU mode only)	0-133 ft
Restoration Time	1 second
Idle Code	ff
<b>Group</b>	
Ip Address	0.0.0.0
<b>Bundle</b>	
Enter Bundle Number	1
Connect	No
Function	TDMoIP
Max Bytes In Multiplexed Frame	500
Destination IP	0.0.0.0
Destination Bundle	1
Packetizing Interval	30
Connectivity Packet Rate	60
Connectivity Timeout Cycles	3
TOS Parameters (Precedence)	Routine
TOS Parameters (Delay)	Normal
TOS Parameters (Throughput)	Normal
TOS Parameters (Reliability)	Normal Reliability
Coder/Rate	G.723.1/6.4
Fax/Modem	Enable
Fax/Modem (Rate)	4.8 kbps
MF Relay	Disable
Minimum Pulse Width	30 msec
Minimum Power Level	0 dBm
VLAN Parameters (Vlan exists)	No
VLAN Parameters (Vlan ID)	26
VLAN Parameters (Vlan Priority)	0



Table 3-3. Vmux-2100 Default Settings (Cont.)

Parameter	Default Value
<b>External E1</b>	
Connect	No
Frame	732S
Restoration Time	1 second
Clock Source	Lbt
Interface Type	Ltu
Idle Code	ff
Signaling	CAS
Profile	1
<b>External T1</b>	
Connect	No
Clock Source	Lbt
Frame	Esf
Interface Type	Dsu
Line Code	B8ZS
Rx Sensitivity (CSU mode only)	LOW (-30 dB)
Tx Gain Level (CSU mode only)	0 dBm
Line Length (DSU mode only)	0-133 ft
Restoration Time	1 second
Idle Code	ff
Signaling	CAS
Profile	1
<b>External Timeslot</b>	
Update from Time Slot	1
To Time Slot	1
Type	N.C.
Bundle	1
Destination Port ID	1
Destination Time Slot	1



# Chapter 4

---

## Management from a Terminal

The configuration of Vmux-2100 is performed via menu-driven embedded software, using a standard ASCII terminal or a PC running a terminal emulation application connected to the rear panel CONTROL port. Alternatively, you can configure Vmux-2100 via Telnet connection, which also establishes an inband management link to the remote unit.

---

### 4.1 Preparing for the Control Session

This section describes how to prepare Vmux-2100 and the supervisory terminal for the control session.

#### Control Port Interface Characteristics

Vmux-2100 includes a V.24/RS-232 asynchronous DCE port, designated CONTROL and terminated in a 9-pin D-type female connector. The control port continuously monitors the incoming data stream and immediately responds to any input string received through this port.

The terminal can be connected either directly to the Vmux-2100 control port, or through a modem or any other type of full-duplex data link.

- Direct connection to terminals. Since terminals usually have DTE interfaces, the connection to the port is made by means of a straight cable.
- Connection through a modem or data link. In this case, you need a cross cable (RAD's CBL-VMUX-MM-MODEM) to connect to the CONTROL connector (see [Appendix A](#) for the cross cable wiring diagram).

#### Preparing the Terminal

Any standard ASCII terminal (a “dumb” terminal or a personal computer running a terminal emulation application) equipped with a V.24/RS-232 communication interface can be used to configure Vmux-2100. [Appendix A](#) details the pin assignment and control signal directions of the Vmux-2100 control connector.

#### Data Terminal Ready (DTR)

When connected and turned on, the terminal sets the DTR line ON (active) to gain control over Vmux-2100 and starts a configuration or monitoring session.

## Initiating a Control Session

Vmux-2100 supports two default terminal rates:

- 115.2 kbps, for 20–30 seconds after the power-up, until the boot sequence is completed. Supervisory terminal connection may be required at this stage for software downloading purpose.
- 9.6 kbps, during normal operation.

### ► To initiate a control session:

1. Connect the terminal cable to the CONTROL connector of Vmux-2100.
2. Turn the control terminal on.
3. Configure the terminal to the default communication parameters: 9.6 kbps, one start bit, eight data bits, no parity, one stop bit, no flow control, VT100 emulation.

You are now ready to start a control session.

## Levels of Security

Vmux-2100 supports a four-level security and user authentication system:

- **Administrator** – Allowed to configure all the parameters of Vmux-2100.
- **Operator** – Allowed to perform all operations in the system, except for user administration (adding/deleting users, changing user definitions).
- **Technician** – Allowed to test Vmux-2100 and monitor its operation (for example, monitoring alarms).
- **Monitor** – Allowed to monitor the Vmux-2100 operation.

The maximum number of the users supported by Vmux-2100 is 20. When managing Vmux-2100 over Telnet, up to five simultaneous management are permitted. Only one administrator is allowed to enter the management session at a time.

Vmux-2100 displays the management menus in accordance with a user's access rights. For example, configuration screens dealing with the unit configurations are not available for the users, who logged in as technicians or monitors.

## Default Security Configuration

Vmux-2100 is supplied with one administrator account:

- User name: admin
- Password: 12345.

When the first management session is initiated, it is recommended to create a new administrator account, and delete the default one.

---

**Note** *If the password is lost, consult your local RAD distributor.*

---

---

## 4.2 Navigating the Management Menus

This section provides a general description of the software menu operation and conventions for navigating the menus. [Appendix C](#) lists all menus of the Vmux-2100 management software.

### Selecting Parameters

- **To choose an option:**
  - Type the number corresponding to the option, and press **<Enter>**.  
The screen for the selected option is displayed.
- **To correct an erroneous entry:**
  - Press **<Backspace>** to clear the error, then enter the correct characters.  
or  
Press **<Esc>** to exit the current menu, and then return to the menu to re-enter the required value.

### Saving and Aborting Selected Values

You must save the selected values by updating the Vmux-2100 database. If the database is not updated, Vmux-2100 discards all the user settings when it is reset. You can save selected values at any stage of the configuration procedure. Alternatively, you can abort the new settings and return to the previous values.

- **To save the changes:**
  1. Type **@** and press **<Enter>**.  
Vmux-2100 displays the following confirmation message:  
**Are you sure you want to update data base ?**  
**Press Y/N :**
  2. Type **Y** to save the changes.

---

**Note** Each time you update the Vmux-2100 database, the management software analyzes the changes. If a major error is detected, Vmux-2100 aborts the database update and displays the following message:  
**Data base wasn't changed. Sanity Error - Check alarm.**  
In this case, check the sanity error, as described in Chapter 7, and re-enter the erroneous values.

---

- **To undo the changes:**
  1. Type **#** and pressing **<Enter>**.  
Vmux-2100 displays the following confirmation message:  
**Are you sure you want to undo data base ?**  
**Press Y/N :**
  2. Type **Y** to abort the changes and use the previous database settings.

### 4.3 Starting the Control Session

Once you have installed Vmux-2100, and completed the installation and operation procedures described in [Chapter 2](#) and [Chapter 3](#), you can start the control session.

You have to enter a user name and password in order to start the Vmux-2100 management software (see [Figure 4-1](#)).

```
USERNAME:
PASSWORD:

ESC - clear; & - exit
```

*Figure 4-1. Password Request Screen*

► **To enter the user name and password:**

1. Type in your user name, and press **<Enter>**.
2. Type in your password (up to eight characters), and press **<Enter>**.

The Main menu is displayed (see [Figure 4-2](#)).

```
Main Menu

1. Inventory
2. Configuration
3. Monitoring
4. Diagnostics

@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

*Figure 4-2. Main Menu*

## 4.4 Displaying the Vmux-2100 Inventory

Vmux-2100 inventory displays information on the types of the voice modules detected in the unit, together with their hardware and software versions.

- **To display the Vmux-2100 inventory:**
  - From the Main menu, choose **Inventory**.

The Vmux-2100 inventory screen appears (see [Figure 4-3](#)).

Inventory				
Main Module	Name	HW Revision	SW Revision	
	Main link IP	01.00	01.00	
Slot 1 Group 1	Not exist			
Slot 1 Group 2	Not exist			
Slot 2 Group 1	2E1 Voice	00.00	01.00	
Slot 2 Group 2	Not exist			
Slot 3 Group 1	Not exist			
Slot 3 Group 2	Not exist			
Slot 4 Group 1	Not exist			
Slot 4 Group 2	Not exist			

@ - Db Update; # - Db Undo  
ESC-prev.menu; !-main menu; &-exit

Figure 4-3. Vmux-2100 Inventory

## 4.5 Configuring the Vmux-2100 System

The Vmux-2100 management software allows you to perform the following:

- Configuring parameters of the Ethernet management connection
- Managing the user database (adding/deleting/changing user details)
- Configuring control port for ASCII terminal connection
- Defining the signaling bits table (for CAS signaling)
- Configuring SS7 keep-alive suppression rate (for CCS signaling)
- Controlling the software versions (see [Appendix B](#))
- Changing the real-time system clock settings
- Resetting Vmux-2100.

- **To display the System Configuration menu:**

1. From the Main menu, choose **Configuration**.

The Configuration menu appears (see [Figure 4-4](#)).

```
Configuration

1. System
2. Hub
3. Card

@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

Figure 4-4. Configuration Menu

2. From the Configuration menu, choose **System**.

The System menu appears (see [Figure 4-5](#)).

```
System

1. Management
2. Control Port
3. Date & Time Update
4. Factory Default
5. Show Partition information
6. Set the Active Application
7. Reset Card
8. Open Internal Alarms

@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

Figure 4-5. System Menu

## Configuring Ethernet Management Connection

Vmux-2100 can be managed by a network management station, which is located on the LAN connected to the unit's 10/100BaseT port. In order to establish a proper connection, it is necessary to configure the following:

- Host IP address, subnets mask, default gateway, its trap, read and write communities.
- Manager IP addresses.

### Configuring the Host IP

The management host parameters are configured via the Host IP menu.

► **To configure the IP host parameters:**

1. From the System menu, choose **Management**.

The Management menu appears (see [Figure 4-6](#)).



```
Management
1. Host IP
2. Manager List
3. Host Mux Name          ...
4. User Administration
5. Signaling Configuration
6. Telnet                  (Enable)

@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

Figure 4-6. Management Menu

2. From the Management, choose **Host IP**.

The Host IP menu appears (see [Figure 4-7](#)).

```
Host IP
1. Set Host IP address    ... (170.185.190.15)
2. Set Subnet Mask        ... (255.255.255.0)
3. Set Default Gateway    ... (170.185.190.1)
4. Trap... (public)
5. Read... (public)
6. Write...(private)

@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

Figure 4-7. Host IP Menu

3. From the Host IP menu, choose the following:
  - **Set Host IP address** to define the host IP
  - **Set Subnet Mask** to define the subnet mask
  - **Set Default Gateway** to set the default gateway IP
  - **Trap...** to enter the name of a community to which the Vmux-2100 will send traps
  - **Read...** to enter the name of a community with read-only authorization
  - **Write...** to enter the name of a community with write authorization.
4. Enter the desired value, and press **<Enter>**.

## Defining the Manager List

You can define the network management stations to which the SNMP agent of Vmux-2100 will send traps. Up to ten managers can be defined.

### ► To define the manager list:

1. From the Management menu, choose **Manager List**.

The Manager List menu appears (see [Figure 4-8](#)).

```

Manager List

    Managers ID      IP Address
      1             170.185.190.5
      2             0.0.0.0
|      3             0.0.0.0
v      4             0.0.0.0
      5             0.0.0.0

1. Change cell      (170.185.190.5)
>

@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit ?-help

```

Figure 4-8. Manager List Menu

2. Select a manager IP address by pressing **<Shift> U** to scroll up or **<Shift> D** to scroll down.
3. Choose **Change cell** (type **1**, and press **<Enter>**) to enter/edit the selected manager IP address.
4. Enter the desired IP address, and press **<Enter>**.

## Managing the User Database

An administrator manages the database of the users who are allowed to operate or monitor the Vmux-2100 system. This allows the administrator to do the following:

- Add a new user
- Delete an existing user
- Change user's details, including the name, password or access level
- Display the list of the users, including date and time

### Adding a New User to the Database

#### ► To add a new user:

1. From the Management menu (see [Figure 4-6](#)), choose **User Administration**.

The User Administration menu appears (see [Figure 4-9](#)).

```
User Administration

1. Add New User
2. Delete User
3. Change User Details
4. Show All Users
>

@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

Figure 4-9. User Administration Menu

2. From the User Administration menu, choose **Add New User**.

The Add New User menu appears (see [Figure 4-10](#)).

```
Add New User

1. Enter UserName          ... ()
2. Enter Access Level      >  (x)
3. Enter Password         ...
4. Enter Password         ...
>

@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

Figure 4-10. Add New User Menu

3. From the Add New User menu, choose **Enter UserName**.
4. Enter a new user name, and press **<Enter>**.

The new user name is displayed.

---

**Note** *User names are case-sensitive.*

---

5. Choose **Enter Access Level** to define the new user access level.
6. Select the desired level (Monitor, Technician, Operator or Administrator).  
The access level of a new user is displayed.
7. Choose **Enter Password**.
8. Enter the new user password (four to eight characters), and press **<Enter>**.  
Vmux-2100 responds to the password entry with asterisks.
9. Choose **Confirm Password and save**.
10. Enter the new user password, and press **<Enter>** to save it.

## Deleting an Existing User from the Database

### ► To delete an existing user:

1. From the User Administration menu, choose **Delete User**.

The Delete User menu appears (see [Figure 4-11](#)).

```
Delete User

1. Enter UserName (to delete)      ... ()
2. Confirm and delete              ...

@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

Figure 4-11. Delete User Menu

2. From the Delete User menu, choose **Enter UserName (to delete)**.
3. Enter the name of the user that you intend to delete, and press **<Enter>**.
4. From the Delete User menu, choose **Confirm and delete**.
5. Enter administrator password to confirm the deletion.

## Changing the User Details

Administrator is allowed to change user's password and access level.

### ► To change user details:

1. From the User Administration menu, choose **Change User**.

The Change User Details menu appears (see [Figure 4-12](#)).

```
Change User Details

1. Enter UserName (to change)      ... ()
2. Change password                  ...
3. Confirm and save password        ...
4. Change access level              > (x)
5. Confirm and save access level    ...

@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

Figure 4-12. Change User Details Menu

2. From the Change User Details menu, choose **Enter UserName (to change)** and then enter the name of the user, whose details you want to change.
3. To change the user password, choose **Change password** and then enter a new password.

4. Choose **Confirm and save password** and then re-enter the new password to confirm the change.
5. To change the user access level, choose **Change access level** and then enter a new value (Monitor, Technician, Operator or Administrator) from the [Change Access Level](#) menu.
6. Choose **Confirm and save access level** and then enter the administrator password to confirm the change.

### Displaying the User List

➤ **To display a list of registered users:**

- From the User Administration menu, choose **Show all users**.

The Show All Users screen appears (see [Figure 4-13](#)).

Show All Users			
	UserName	Access Level	DBchange Date DBchange Time
1	admin	Administrator	6/3/2001 18:16:5
2	qwerty	Monitor	
@ - Db Update; # - Db Undo			
ESC-prev.menu; !-main menu; &-exit			

Figure 4-13. Show All Users Screen

### Controlling Telnet Access

You can disable Telnet access to Vmux-2100.

By disabling Telnet, you prevent unauthorized access to the system when security of the Vmux-2100 IP address has been compromised. When Telnet access is disabled, Vmux-2100 can be managed via an ASCII terminal or RADview.

➤ **To disable the Telnet access:**

1. From the Management menu ([Figure 4-6](#)), choose **Telnet**.

The Telnet value toggles between Enable and Disable.

2. Set to 'Disable'.

## Configuring the Control Port

Vmux-2100 allows you to configure the baud rate, timeout period, and connection of a dial-in modem to the rear panel CONTROL port.

### Configuring the Data Rate

The Vmux-2100 control data port supports baud rates in the range of 9.6 to 115.2 kbps.

► **To configure the baud rate:**

3. From the System menu (see [Figure 4-5](#)), choose **Control Port**.

The Control Port menu appears (see [Figure 4-14](#)).

```
Control Port

1. Set Baud Rate (bps) > (9600)
2. Timeout (minutes) [3 - 10]... (10)
3. Dial-In Modem > (Disable)

Please select item <1 to 3>
@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

*Figure 4-14. Control Port Menu*

4. Choose **Set Baud Rate** from the Control Port menu.
5. Select a new baud rate from the Set Baud Rate menu.

### Configuring the Timeout

The timeout specifies a time interval after which Vmux-2100 automatically disconnects from the supervisory terminal if no input from the user is detected. The timeout can be set for between 3 to 10 minutes.

► **To configure the timeout:**

1. From the Control Port menu, choose **Timeout**.
2. Enter the desired number of minutes and press **<Enter>**.

## Enabling/Disabling Dial-in Modem Access

A dial-in modem can be connected to the CONTROL port for remote management.

► **To enable or disable dial-in modem connection via the CONTROL port:**

1. From the System menu (see [Figure 4-5](#)), choose **Control Port**.

The Control Port menu appears (see [Figure 4-14](#)).

2. From the Control Port menu, choose **Dial-In Modem**.

The Dial-In Modem menu appears.

3. From the Dial-In Modem menu, choose:
  - **Disable** to disable connection of a dial-in modem to the control port
  - **Enable** to enable connection of a dial-in modem to the control port.

---

**Note** *If an ASCII terminal or PC is connected directly to the control port while the dial-in modem access option is enabled, signals from the terminal or PC may be confused with modem control signals by the Vmux-2100 modem auto detect capability and inadvertently cause the Vmux-2100 to disable the terminal or PC connection. To avoid this situation, verify that the Control port dial-in modem access is set to **Disable** (this is the default setting) before attempting to make a direct terminal or PC connection to the Control Port (this can be accomplished safely via Telnet). If dial-in modem access is not required, it is recommended to leave this option disabled.*

---

## Configuring Signaling Information

Vmux-2100 allows you to configure the signaling parameters according to the selected signaling mode: CAS for E1, Robbed Bit MF for T1 or CCS for E1/T1. Signaling mode is selected via the E1 Parameters menu of the voice card (see the [Configuring External E1/T1 Ports](#) section below).

- **CAS/Robbed Bit MF** – You must configure a signaling profile and signaling table associated with it (ABCD bits, idle code and OOS signals).
- **CCS** – When working with CCS-SS7, you can configure the fill-in packets flow by selecting the SS7 keep-alive suppression rate.

### Configuring Signaling Profiles

If you are using CAS signaling, you must configure the signaling system of Vmux-2100 to make it compatible with the signaling method used by the PBXs connected to the voice E1/T1 ports. The management software allows you to manipulate the ABCD signaling bits and methods of representation of the idle code and out-of-service signals generated by the PBXs (see [Table 4-1](#)). Signaling conversion is used for connection of PBXs, which use different signaling formats.

You can store up to five signaling profiles; Vmux-2100 uses only one of them at a time. The signaling profile selection is performed via the E1 Parameters menu of the voice card (see the [Configuring External E1/T1 Ports](#) section below).

---

**Note** *The signaling profile configuration is available only for the units operating with CAS signaling.*

---

#### ► To configure the signaling profile:

1. From the Management menu (see [Figure 4-6](#)), choose **Signaling Configuration**  
The Signaling Configuration menu appears (see [Figure 4-15](#)).

```

Signaling Configuration

1. Signaling Profile Configuration
2. SS7 Keep-Alive Suppression Rate  (0% - No Suppression / Not SS7)

@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit

```

Figure 4-15. Signaling Configuration Menu

- From the Signaling Configuration menu, choose **Signaling Profile Configuration**.

The Signaling Profile Configuration menu appears (see [Figure 4-16](#)).

```

Signaling Profile Configuration

1. Enter Profile Number To Configure [1 - 5... (1)
2. Signaling Table Configuration          []>

@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit

```

Figure 4-16. Signaling Profile Configuration Menu

- From the Signaling Profile Configuration menu, choose **Enter Profile Number To Configure**.
- Enter the number of the signaling profile that you want to configure by typing a number from **1** to **5**, and pressing **<Enter>**.
- From the Signaling Profile Configuration menu, choose **Signaling Table Configuration**.

The Signaling Table Configuration menu appears (see [Figure 4-17](#)).

```

Signaling Table Configuration

      ABCD BITS      A Bit  B Bit  C Bit  D Bit
      IDLE SIGNAL    1      0      1      1
      OOS  SIGNAL    1      0      1      1

1. 0          8. NOT C
2. 1          9. D
3. A         10. NOT D
4. NOT A
5. B
6. NOT B
7. C

@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit ?-help

```

Figure 4-17. Signaling Table Configuration Menu



6. In the signaling table, select a signaling bit that you want to configure by pressing **<Tab>**.
7. Configure the signaling bit by typing a number corresponding to the desired value (see [Table 4-1](#)), and pressing **<Enter>**.

Table 4-1. Signaling Bits Configuration

Parameter	Description	Value
A, B, C, D Bit	Selects which incoming bit (from the remote side) to transmit on the A bit toward the Vmux-2100's local PBX.	<b>0</b> – Transmits zero <b>1</b> – Transmits one <b>A</b> – Transmits the incoming A bit <b>B</b> – Transmits the incoming B bit <b>C</b> – Transmits the incoming C bit <b>D</b> – Transmits the incoming D bit <b>NOT A</b> – Inverts the incoming A bit and transmits it <b>NOT B</b> – Inverts the incoming B bit and transmits it <b>NOT C</b> – Inverts the incoming C bit and transmits it <b>NOT D</b> – Inverts the incoming D bit and transmits it
IDLE SIGNAL	Selects the code transmitted on A, B, C, and D bit when the channel is idle	<b>0</b> – Transmits zero <b>1</b> – Transmits one
OOS SIGNAL	Selects the code transmitted on A, B, C, and D bit when the channel is out of service	<b>0</b> – Transmits zero <b>1</b> – Transmits one

### Configuring Keep-Alive Suppression Rate

When Vmux-2100 with CCS signaling is connected to the PBXs operating with the SS7 signaling, the PBXs use one timeslot to transmit signaling information. The signaling information is passed over the signaling link in the form of the following signal units:

- **Message signal units** (MSUs) provide all signaling associated with call setup and tear down, database query and response, and SS7 network management.
- **Link status signal units** (LSSUs) provide information on the link status between the network nodes (initiation of link alignment, quality of the signaling traffic etc).
- **Fill-in signal units** (FISUs) carry no information payload. They occupy the link, when there are no MSUs or LSSUs to send. FISUs are also referred to as “keep-alive” messages.

Often, in the absence of signaling traffic, the signaling links become flooded with the FISUs, causing communication disruptions. In order to prevent this, you can enforce Vmux-2100 to drop certain amount of FISUs (up to 90%). You can also disable the FISU dropping by configuring the keep-alive suppression rate to 0%. It is necessary, when working with non-SS7 CCS signaling (for example ISDN), or if the FISUs are used to acknowledge the receipt of the signaling messages. In the latter case, system performance may become unsatisfactory.

➤ **To configure the keep-alive suppression rate:**

1. From the Signaling Configuration menu (see [Figure 4-15](#)), choose **SS7 Keep-Alive Suppression Rate**.

The SS7 Keep-Alive Suppression Rate menu appears (see [Figure 4-18](#)).

```
SS7 Keep-Alive Suppression Rate (0%)
1. 0% - No Suppression / Not SS7
2. 10%
3. 20%
4. 30%
5. 40%
6. 50%
7. 60%
8. 70%
9. 80%
10. 90%
>
Please select item <1 to 10>
@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

*Figure 4-18. SS7 Keep-Alive Suppression Rate Menu*

2. From the SS7 Keep-Alive Suppression Rate menu, type a number corresponding to the desired value, and press **<Enter>**.

## Assigning a Name to Vmux-2100

The Vmux-2100 management software allows you to assign a name to the unit to distinguish it from the other devices installed in your system.

➤ **To assign a name:**

3. From the Management menu (see [Figure 4-6](#)), choose **Host Mux Name**
4. Enter a name for the Vmux-2100, and press **<Enter>**.

Assigned name appears at the top of each terminal screen.

## Setting Date and Time

You can set the time for the Vmux-2100 internal real-time clock.

➤ **To set date and time:**

1. From the System menu (see [Figure 4-5](#)), choose **Date & Time Update**.

The Date & Time Update menu appears (see [Figure 4-19](#)).

```

Date & Time Update

1. Set Time (hh:mm)... (13:23)
2. Set Date (dd/mm/yyyy)... (4/2/2002)

@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit

```

Figure 4-19. Date & Time Update Menu

2. From the Date & Time Update menu, choose **Set Time**.
3. Enter a new time value in the hh:mm format, and press **<Enter>**.
4. From the Date & Time Update menu, choose **Set Date**.
5. Enter a new date value in the dd/mm/yyyy format, and press **<Enter>**.

## 4.6 Entering Main Link and Voice Modules into the Database

Before starting the configuration process of the 10/100BaseT and E1/T1 ports of Vmux-2100, it is necessary to identify the modules installed in your system and enter their types into the unit database. You can perform identification prior to the physical installation of the modules. This allows you to reduce the system downtime by preparing Vmux-2100 for a new configuration or upgrade.

**Note** You can check the number and types of the main link and voice modules currently installed in Vmux-2100 by displaying the unit's inventory (**Main Menu > Inventory**).

➤ **To identify the modules:**

1. From the Configuration menu, choose **Hub**.  
The Hub menu appears (see [Figure 4-20](#)).

```

Hub

1. Main Board > (M-IPE1)
2. Slot 1 > (NO CARD)
3. Slot 2 > (NO CARD)
4. Slot 3 > (NO CARD)
5. Slot 4 > (NO CARD)

@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit

```

Figure 4-20. Hub Menu

2. From the Hub menu, choose **Main Board** to select the main link module.  
The Main Board menu appears.

3. From the Main Board menu, select one of the following module types:
  - M-IP – 10/100BaseT port only
  - M-IPE1 – 10/100BaseT port and E1 port
  - M-IPT1 – 10/100BaseT port and T1 port.
4. From the Hub menu, choose **Slot 1** to select the slot 1 module.

The Slot 1 menu appears.
5. From the Slot 1 menu, select one of the following module types:
  - NO CARD – No module installed in slot 1
  - V-2E1 – Two E1 ports
  - V-4E1 – Four E1 ports
  - V-2T1 – Two T1 ports
  - V-4T1 – Four T1 ports.
6. Repeat step 4 and step 5 to select the module types for all utilized Vmux-2100 slots.

---

## 4.7 Configuring Main Link and Voice E1/T1 Ports

Once the main link and voice E1/T1 modules are installed in Vmux-2100 and identified by the system, you can start configuring the E1/T1 and Ethernet connections of the unit.

It is recommended to configure the main link and voice (external) E1/T1 ports in the following order:

1. Configure the main link:
  - Set the Ethernet parameters of the main link 10/100BaseT port, if necessary (autonegotiation or LAN mode).
  - Configure the E1/T1 parameters of the main link, if necessary (framing mode, restoration time, clock source, interface type, idle code).
  - Assign the E1/T1 main link timeslots to carry user data.
2. Configure external E1/T1 at a group (two E1/T1 ports of the same module) level:
  - Assign IP address to a group.
  - Add bundles to a group (up to five bundles per group)
  - Configure each bundle (frame size, destination IP, destination bundle, packetizing interval, TOS parameters, compression method, fax relay, VLAN parameters).
3. Configure external E1/T1 at a single E1/T1 level:
  - Configure each E1/T1 port at the physical level (framing mode, restoration time, clock source, interface type, idle code, signaling type, signaling profile).

- Configure the timeslots of each E1/T1 port (voice or data, mapping to specific bundles, routing to remote ports and timeslots).

## Configuring the Main Link

The main link module of Vmux-2100 may include 10/100BaseT port and E1/T1 port.

### Configuring the Ethernet Port

The Ethernet port of the Vmux-2100 main link module supports autonegotiation. If the autonegotiation is disabled, the Ethernet port can be configured to operate in 10BaseT (half duplex or full duplex) or 100BaseT (half duplex or full duplex) mode.

➤ **To configure the Ethernet port:**

1. From the Configuration menu (see [Figure 4-4](#)), choose **Card**.

The Card menu appears (see [Figure 4-21](#)).

```
Card
1. Main board
2. Slot 1
3. Slot 2

@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

*Figure 4-21. Card Menu*

2. From the Card menu, choose **Main board**.

The Main Board menu appears (see [Figure 4-22](#)).

```
Main Board
1. Lan Parameters
2. E1 Parameters

@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

*Figure 4-22. Main Board Menu*

3. From the Main Board menu, choose **Lan Parameters**.

The Lan Parameters menu appears (see [Figure 4-23](#)).

```

Lan Parameters

1. Set Auto Negotiation      (Disable)
2. Set Capability >        (100baseT Full Duplex)

@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit

```

Figure 4-23. Lan Parameters Menu

4. From the Lan Parameters menu, choose **Set Auto Negotiation** to enable or disable the autonegotiation.
5. If the autonegotiation is disabled, choose **Set Capability** from the Lan Parameters menu.

The Set Capability menu appears.

6. Select the desired LAN operation mode by choosing one of the following:
  - 10BaseT half duplex
  - 10BaseT full duplex
  - 100BaseT half duplex
  - 100BaseT full duplex.

### Configuring the E1 Main Link Port

The M-IPE1 main link modules include two fully redundant E1 ports. When both of them are configured as active, Vmux-2100 starts sending data over the one that has been connected first. If a loss of synchronization is detected on an active link, Vmux-2100 automatically switches to the backup.

➤ **To configure the main link E1 port:**

1. From the Main Board menu (see [Figure 4-22](#)), choose **E1 Parameters**.

The E1 Parameters menu appears (see [Figure 4-24](#)).

```

E1 Parameters

1. Main Link 1
2. Main Link 2
3. Time Slot Table

@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit

```

Figure 4-24. E1 Parameters Menu

2. From the E1 Parameters menu, choose **Main Link 1** to configure E1 port 1 or choose **Main Link 2** to configure E1 port 2.

The Main Link 1/2 menu appears (see [Figure 4-25](#)).

```

Main Link 1 or Main Link 2

1. Connect > (Yes)
2. Frame    >   (G.732S)
3. Restoration Time>   (CCITT)
4. Clock Source>   (Lbt      (Local))
5. Interface Type>   (Ltu)
6. Idle Code   [0 - ff]... (ff)

@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit

```

Figure 4-25. Main Link 1/2 Menu for E1 Port Module

3. From the Main Link 1/2 menu, configure the following E1 parameters:
  - Connect:
    - **Yes** (E1 link is enabled)
    - **No** (E1 link is disabled).
  - Frame (E1 framing mode):
    - **G.732N** (256N multiframe, 2 frames per multiframe, CRC-4 function disabled)
    - **G.732N-CRC4** (256N multiframe, 2 frames per multiframe, CRC-4 function enabled)
    - **G.732S** (256S multiframe, 16 frames per multiframe, CRC-4 function disabled)
    - **G.732S-CRC4** (256S multiframe, 16 frames per multiframe, CRC-4 function enabled).
  - Restoration Time (time required for the E1 port to return to normal operation after sync loss):
    - **1 Second** (after 1 second, fast)
    - **10 Second** (as per requirements of AT&T TR-62411)
    - **CCITT** (as per requirements of ITU-T Rec.G.732).
  - Clock Source:
    - **Lbt** (derived from the received E1 signal)
    - **Internal** (received from the Vmux-2100 internal oscillator).
  - Interface Type (maximum attenuation of the Rx signal that can be compensated for by the port Rx path, to obtain BER performance required by the standards):
    - **Ltu** (maximum attenuation of 43 dB, relative to the nominal transmit level of 0 dB, operates at longer ranges)
    - **Dsu** (maximum attenuation of 12 dB, relative to the nominal transmit level of 0 dB).

- Idle Code (code transmitted to fill unused timeslots in the E1 frames):  
**00** to **ff**.
4. From the E1 Parameters menu, choose **Time Slot Table** to assign the E1 main link to carry the user data (and idle code).

The Time Slot Table menu appears.

Timeslots that are connected (assigned to carry data) are marked **Yes**; timeslots that are disconnected (not assigned) are marked **No**.

#### Time Slot Table

Ts#	1	2	3	4	5	6	7	8	9	10	11	12
	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No
Ts#	13	14	15	16	17	18	19	20	21	22	23	24
	No	No	No	No	Yes	No	No	No	No	No	No	No
Ts#	25	26	27	28	29	30	31					
	No	No	No	No	No	No	No					

1. No
2. Yes

>

@ - Db Update; # - Db Undo  
ESC-prev.menu; !-main menu; &-exit

Figure 4-26. Time Slot Table (for E1 Link)

5. From the Time Slot Table, toggle between timeslots by pressing **<Tab>**, and assign the timeslot(s) that are to carry data by entering **Yes**. To disconnect a timeslot, enter **No**.

**Note** Since Vmux-2100 uses only one E1 main link at a time, the timeslot mapping is applicable also for the inactive E1 port.

## Configuring the T1 Main Link Port

The procedure for configuring the T1 main link port is similar to the procedure described above for configuring the E1 main link port. The following parameters, which are configured via the Main Link 1 or Main Link 2 menu (see [Figure 4-27](#)), are unique to the T1 links:



```

Main Link 1 or Main Link 2

1. Connect > (Yes)
2. Clock Source> (Lbt (Local))
3. Frame > (Esf)
4. Interface Type> (Csu))
5. Line Code> (B8ZS)
6. Rx Sensitivity> (LOW (-30dB))
7. Tx Gain Level> (0 dBm)
8. Restoration Time> (1 Second (Fast))
9. Idle Code [0 - ff]... (68)

@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit

```

Figure 4-27. Main Link 1/2 Menu for T1 Port Module

- Frame (T1 framing mode):
  - **Esf** (24 frames per multiframe)
  - **SF (D4)** (12 frames per multiframe).
- Interface Type:
  - **DSU** (DSU interface)
  - **CSU** (CSU interface).
- Line Code (line code and zero suppression method used by the port):
  - **B8ZS** (B8ZS coding).
- Rx Sensitivity (CSU mode only, maximum attenuation of the Rx signal that can be compensated for by the port Rx path, to obtain BER performance required by the standards):
  - **Low** (-30 dB) (-30 dB relative to the nominal transmit level of 0 dB)
  - **High** (-36 dB) (-36 dB relative to the nominal transmit level of 0 dB).
- Tx Gain Level (CSU mode only, relative T1 output transmit level):
  - **0 dB** (no attenuation)
  - **7.5 dB** (attenuation of 7.5 dB relative to the nominal transmit level)
  - **15 dB** (attenuation of 15 dB relative to the nominal transmit level)
  - **22.5 dB** (attenuation of 22.5 dB relative to the nominal transmit level)
- Line Length (DSU mode only, length of a cable in feet between the Vmux-2100 T1 port connector and the network access point):
  - **0–133 Feet**
  - **133–266 Feet**

- **266–399 Feet**
- **399–533 Feet**
- **533–655 Feet.**

Next, the timeslots that are to carry user data are assigned by choosing **Time Slot Table** From the T1 Parameters menu (as described for the E1 links)

Time Slot Table												
Ts#	1	2	3	4	5	6	7	8	9	10	11	12
	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No
Ts#	13	14	15	16	17	18	19	20	21	22	23	24
	No	No	No	No	Yes	No	No	No	No	No	No	No
1. No												
2. Yes												
@ - Db Update; # - Db Undo												
ESC-prev.menu; !-main menu; &-exit												

Figure 4-28. Time Slot Table (for T1 Link)

From the Time Slot Table, toggle between timeslots by pressing **<Tab>**, and assign the timeslot(s) that are to carry data by entering **Yes**. To disconnect a timeslot, enter **No**.

**Note** Since Vmux-2100 uses only one T1 main link at a time, the timeslot mapping is applicable also for the inactive T1 port.

## Configuring E1/T1 Groups and Bundles

Each pair of external E1/T1 ports of the Vmux-2100 voice module is referred to as a *group*. Vmux-2100 supports up to eight E1/T1 groups.

### Configuring a Group

You have to assign an IP address to each E1/T1 group.

#### ➤ To assign an IP address to a group:

1. From the Card menu, select a slot, to which belong a group you want to configure by choosing the corresponding number.

The Slot menu appears (see [Figure 4-29](#)).

```
Slot 1
1. Group 1
2. Group 2

@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

Figure 4-29. Slot Menu

2. From the Slot menu, select a group to configure.  
The Group menu appears (see [Figure 4-30](#)).

```
Group 1
1. IP Address ... (0.0.0.0)
2. Bundles Parameters
3. External 1
4. External 2

@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

Figure 4-30. Group Menu

3. From the Group menu, choose **IP Address**.
4. Enter the desired IP address, and press **<Enter>**.

### Configuring Bundles

E1/T1 timeslots are grouped together into bundles. The payload of each E1/T1 group can be arranged into up to five bundles, with maximum of 60 timeslots per bundle.

Before configuring bundles, you must add at least one bundle to a group.

► **To add a bundle:**

1. From the Group menu, choose **Bundles Parameters**.  
The Bundles Parameters menu appears (see [Figure 4-31](#)).

```
Bundles Parameters
1. Display Bundles
2. Bundle Configuration

@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

Figure 4-31. Bundles Parameters Menu

2. From the Bundles Parameters menu, choose **Bundle Configuration**.  
The Bundle Configuration menu appears (see [Figure 4-32](#)).

```
Bundle Configuration

1. Add Bundle
2. Delete Bundle
3. Edit Bundle
@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

Figure 4-32. Bundle Configuration Menu

3. From the Bundle Configuration menu, choose **Add Bundle**.

The Add Bundle menu appears.

4. Add a bundle by choosing its number.

► **To configure an existing bundle:**

1. From the Bundle Configuration menu (see [Figure 4-32](#)), choose **Edit Bundle**.

The Edit Bundle menu appears (see [Figure 4-33](#)).

```
Edit Bundle

1. Enter Bundle Number [1 - 5]... (1)
2. Connect > (No)
3. Function> (TDMoIP)
4. Max Bytes In Multiplexed Frame [100 - 1461]... (500)
5. Destination IP... (0.0.0.0)
6. Destination Bundle[1 - 5]... (1)
7. Packetizing Interval (msec)[10 - 90]... (30)
8. Connectivity Parameters
9. TOS Parameters
10. Voice Parameters
11. VLAN Parameters
12. Bundle Name... ()

@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

Figure 4-33. Edit Bundle Menu

2. From the Edit Bundle menu, choose **Enter Bundle Number** and select a bundle (1 through 5) to configure.
3. Configure the following parameters of the selected bundle:
  - Connect:
    - **Yes** (bundle is connected)
    - **No** (bundle is not connected)

- Function:
  - **TDMoIP**
- Max Bytes In Multiplexed Frame (size of a multiplexed TDMoIP frame in bytes):
  - **100 to 1461** bytes
- Destination IP (IP address of the destination group)
- Destination Bundle (number of destination bundle of the group with IP specified in the previous step)
- Packetizing Interval (msec) (time interval allotted for the TDMoIP frame aggregation):
  - **10 to 90** msec
- Connectivity parameters – keep-alive messages configuration (see Figure 4-34):

```

Connectivity Parameters
1. Connectivity-packet rate (sec) [1 - 60]... (60)
2. Connectivity timeout cycles [1 - 5] ... (3)

@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit

```

*Figure 4-34. Connectivity Parameters Menu*

Vmux-2100 constantly monitors status of all connected bundles by sending the 64-byte keep-alive messages to remote device. Connectivity is confirmed by receiving a reply from the remote unit. This process is similar to pinging remote IP hosts. If reply is not received, usually due to the main link failure, Vmux-2100 disconnects the bundle and generates the BUNDLE IS OOS alarm. When the BUNDLE IS OOS alarm is generated, Vmux-2100 notifies appropriate PBX by sending “all 1s” string (CCS signaling) or OOS message (CAS signaling) on all timeslots of the disconnected bundle. This notification allows the attached PBX to stop transmitting over a faulty E1 and switch to a backup link.

You can specify the following connectivity parameters:

- **Connectivity packet rate** (frequency of sending the keep-alive packets, from one packet per **1** second to one packet per **60** seconds)
- **Connectivity timeout cycles** (number of attempts within which Vmux-2100 expects to receive at least one reply from the remote device).

For example, if you set the connectivity packet rate to 60 seconds and connectivity timeout to 3, Vmux-2100 disconnects a bundle from which it did not receive at least one reply within 180 seconds.

**Note** When operating Vmux-2100 in a TDM network (for example, leased line), where delays are minimal, you can configure Vmux-2100 to generate the keep-alive packets more frequently to ensure the early notification of a main link failure. In IP networks, where delays are more common, it is recommended to set the connectivity parameters to their maximum values.

- TOS Parameters (standard Type of Service parameters of the outgoing IP frames):
  - **Precedence** (Routine, Priority, Immediate, Flash, Flash Override, Critic/Ecp, Internetwork Control, Network Control)
  - **Delay** (Normal, Low)
  - **Throughput** (Normal, High)
  - **Reliability** (Normal, High).
- Voice Parameters (see [Figure 4-35](#)):

```
Voice Parameters
1. Coder/Rate (kbps) (G.723.1/6.4)
2. Fax/Modem
3. MF Relay (enable)
4. Minimum Pulse Width (milliseconds) [30 - 32676]... (80)
5. Minimum Power Level (negative dBm) [0 - 35]... (0)

@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

Figure 4-35. Voice Parameters Menu

- Coder/Rate (compression algorithm and corresponding rate):
  - G.723.1/6.4** (as per G.723.1 requirements at 6.4 kbps)
  - G.723.1/5.3** (as per G.723.1 requirements at 5.3 kbps)
  - G.729A/8** (as per G.729 A requirements at 8 kbps)
  - G.711 a LAW** (as per G.711 requirements, A-law companding)
  - G.711 u LAW** (as per G.711 requirements,  $\mu$ -law companding).
- Fax/Modem (enable/disable fax or modem signal identification and relay, and define the it transmission rate in kbps): **4.8, 9.6, 14.4**.
- MF Relay (enable/disable MF tone identification and relay).
 

The two following parameters (Minimum Pulse Width and Minimum Power Level) appear only when the MF relay is enabled.
- Minimum Pulse Width (minimum pulse width of the MF tone to be detected and relayed): **30** to **32676** msec.
- Minimum Power Level (minimum power level of the MF tone to be detected and relayed): **0** to **-35** dBm.

---

**Note** *If you intend to change the voice parameters, it is recommended to disconnect a bundle before configuring it. The bundle must be disconnected at the local and remote sites. If you do not disconnect the bundle, you must perform reset of the local and remote voice modules carrying the E1/T1 links which timeslots belong to the bundle. The voice modules must be reset after you complete configuring the voice parameters.*

---

- VLAN Parameters (enable/disable virtual LAN tagging, specify VLAN number, and its priority):
  - Vlan Number: **26** to **4094**
  - Vlan Priority: **0** (minimum) to **7** (maximum).
- Bundle Name (assigning an identification to a bundle).

### Configuring External E1/T1 Ports

Configuration of the external E1/T1 ports located on the Vmux-2100 voice modules (V-2E1, V-4E1, V-2T1, V-4T1) is similar to the configuration of the E1/T1 ports of the main link modules (M-IPE1, M-IPT1). In addition to the standard configuration procedures listed in the [Configuring the E1 Main Link Port](#) and [Configuring the T1 Main Link Port](#) sections above, you must perform the following:

- For T1 links, select a signaling mode:
  - **Robbed Bit MF**
  - **CCS**.
- For E1 links, selecting the frame mode automatically determines the signaling mode:
  - G.732S or G.732S-CRC4 framing: CAS signaling
  - G.732N or G.732N-CRC4 framing: CCS signaling.

---

**Note** *If you intend to change E1/T1 signaling, it is recommended to disconnect a bundle, to which the E1/T1 timeslots are assigned before configuring the signaling mode. The bundle must be disconnected at the local and remote sites. If you do not disconnect the bundle, you must perform reset of the local and remote voice modules carrying the E1/T1 links after you complete configuring the E1/T1 signaling.*

---

- When operating with CAS (for E1 links in G.732S frame modes) or RBMF (for T1 links) signaling, it is necessary to assign a signaling profile to the E1/T1 link. In such cases the **Profile[1 - 5]** option will appear. The profile must be compatible with the PBX signaling (signaling profile configuration is explained in the [Configuring Signaling Information](#) section above).
- Configure the E1/T1 timeslots, as explained below.

Configuration of the E1/T1 ports located on the voice modules is performed via the External 1 and External 2 menus (**Configuration > Card > Slot 1/Slot 2/Slot3/Slot 4 > Group 1/Group2 > External 1/External 2 > E1 Parameters/T1 Parameters**).

#### ➤ To configure E1/T1 timeslots:

1. From the Configuration menu (see [Figure 4-4](#)), choose **Card**.  
The Card menu appears (see [Figure 4-21](#)).

2. From the Card menu, select a slot to configure.  
The Slot menu appears (see [Figure 4-29](#)).
3. From the Slot menu, select an E1/T1 group to configure.  
The Group menu appears (see [Figure 4-30](#)).
4. From the Group menu, select an external E1/T1 to configure by choosing **External 1** or **External 2**.  
The External menu appears (see [Figure 4-36](#)).

```
External 1
1. E1 Parameters
2. Distribution Of Framer Time Slots
@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

*Figure 4-36. External Menu*

5. From the External menu, choose **Distribution Of Framer Time Slots**.  
The Distribution Of Framer Time Slots menu appears (see [Figure 4-37](#)).

```
Distribution Of Framer Time Slots
1. Display Time Slots
2. Time Slots Configuration
@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

*Figure 4-37. Distribution Of Framer Time Slots Menu*

6. From the Distribution Of Framer Time Slots menu, choose **Time Slots Configuration**.  
The Time Slot Configuration menu appears (see [Figure 4-38](#)).

```
Time Slot Configuration
1. Update from Time Slot [1 - 31]... (1)
2. To Time Slot [1 - 31]... (1)
3. Type > (N.C)
4. Bundle[1 - 5]... (1)
5. Destination Port ID[1 - 4]... (1)
6. Destination Time Slot ID[1 - 31]... (1)
7. Update Time Slot
@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

*Figure 4-38. Time Slot Configuration Menu*



7. From the Time Slot Configuration menu, configure the following parameters:
  - Define timeslot(s) to configure by choosing **Update from Time Slot** to select the first timeslot and then choosing **To Time Slot** to select the last timeslot.
  - Select a timeslot type by choosing **Type**:
    - **N.C.** (timeslot is not connected)
    - **Voice** (timeslot transmits voice)
    - **HDLC** (timeslot transmit data, for example, signaling information).
  - Assign a timeslot to a bundle by choosing **Bundle**, and selecting a bundle number.
  - Specify a destination port by choosing **Destination Port ID**, and entering a port number.
  - Define the destination timeslots to which the local timeslots are routed. You only have to specify a starting timeslot; (the rest of the destination timeslots are configured automatically according to the number of timeslots previously set by the Update from Time Slot/To Time Slot parameters).
  - Save the changes that you made to the timeslots by choosing **Update Time Slot**.

**Note** *Make sure to save the changes that you have made to the timeslot configuration.*

8. Check the resulting timeslot configuration by choosing **Display Time Slots** from the Distribution Of Framer Time Slots menu (see [Figure 4-37](#)).

The Display Time Slots screen appears (see [Figure 4-39](#)).

```

Display Time Slots

Ts#      Type      Bundle  Dest  Port      Dest  Ts
  1       N.C       0        1      0        0
  2      Voice      1        4      1        1
|  3      Voice      1        4      2        2
v  4      Voice      1        4      3        3
  5      Voice      1        4      4        4
  6       N.C       0        1      0        0
  7       N.C       0        1      0        0
  8       N.C       0        1      0        0
  9       N.C       0        1      0        0
 10       N.C       0        1      0        0

>
@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit

```

Figure 4-39. Display Time Slots Screen

---

## 4.8 Restoring Default Settings

You can restore default settings of the external E1/T1 ports. Restoring the E1/T1 defaults erases the E1/T1 port identification in the database, user's configuration of the group IP addresses, defined bundles and assigned timeslots. The system and main link parameters are not affected.

► **To restore the Vmux-2100 to the defaults:**

1. From the System menu (see [Figure 4-5](#)), choose **Factory Defaults**.  
Vmux-2100 displays the following message:  
**Are you sure you want to initialize to default configuration (Y/N) ?**
2. Type **Y**, and press **<Enter>**.  
Vmux-2100 restores the settings of the external E1/T1 ports to their default settings.

---

## 4.9 Resetting Vmux-2100

The Vmux-2100 management software allows you to re-initialize a single E1/T1 group of each voice module or a mainboard CPU.

► **To reset the Vmux-2100 components:**

1. From the System menu, choose **Reset Card**.  
The Reset Card menu appears (see [Figure 4-40](#)).

```
Reset Card
1. Reset Slot-1 Group-1
2. Reset Slot-1 Group-2
3. Reset Slot-2 Group-1
4. Reset Slot-2 Group-2
5. Reset Slot-3 Group-1
6. Reset Slot-3 Group-2
7. Reset Slot-4 Group-1
8. Reset Slot-4 Group-2
9. Reset MainBoard
@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

*Figure 4-40. Reset Card Menu*

2. From the Reset Card menu, select a Vmux-2100 component to reset by typing its number, and pressing **<Enter>**.  
Vmux-2100 displays the following message:  
**Are you sure you want to reset the card ? Press Y/N**
3. Type **Y**, and press **<Enter>**.  
The card is re-initialized, its active software is decompressed and loaded into the RAM.

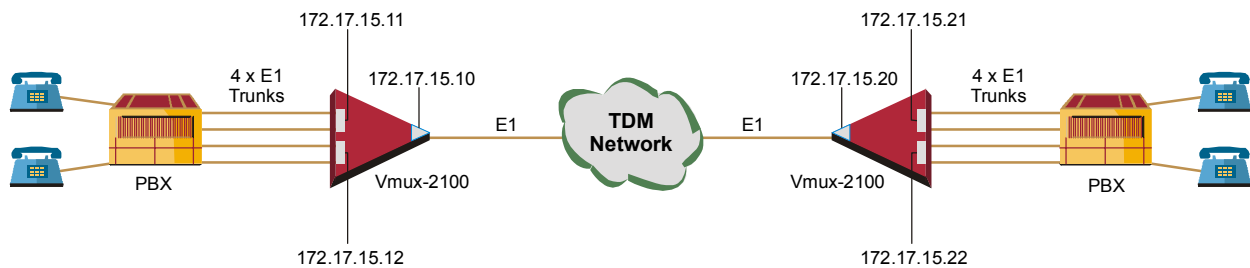
# Chapter 5

## Configuring Vmux-2100 for a Typical Application

This chapter gives detailed instructions for configuring Vmux-2100 for a typical application in which two Vmux-2100 units operate point-to-point over a TDM network.

### 5.1 Application Requirements

*Figure 5-1* illustrates a typical TDM application, in which two Vmux-2100 units with V-4E1 modules transmit four E1 trunks over a single E1 link.



*Figure 5-1. Typical TDM Application*

The following network requirements exist:

- Four E1 trunks over one E1 link
- Each local timeslot carries voice. It is routed to the same timeslot of the corresponding E1 port at the remote site
- CAS signaling or CCS signaling
- G.732S or G.732N framing mode, without CRC-4 bits generation
- G.729 A voice compression
- Loopback timing
- Fax relay at 9.6 kbps.

---

## 5.2 Outline of Configuration Procedure

The recommended configuration procedure of the local and remote Vmux-2100 units include the following steps:

- Configuring of the IP host parameters for both units via an ASCII terminal connection.
  - Installing the two units at their locations.
  - Configuring the local Vmux-2100.
  - Saving the configuration file (cnfg.dat) of the local unit at the management station.
  - Downloading the configuration file to the remote Vmux-2100 and updating its database.
  - Changing the IP addresses of the remote E1/T1 groups to the valid ones.
- 

## 5.3 Configuring Vmux-2100 for Operation with CAS Signaling

Most of the configuration procedures are performed on the local unit, except for the defining IP host parameters, and IP addresses of the remote E1/T1 groups.

Configuration procedure is divided into three main stages:

- Defining system parameters.
- Configuring main link parameters.
- Setting voice card parameters.

---

**Note** *You must save the selected values by updating the Vmux-2100 database. If the database is not updated, Vmux-2100 discards all the user settings when it is reset. You can save selected values at any stage of the configuration procedure.*

---

### Configuring System Parameters

➤ **To configure the Vmux-2100 system parameters:**

1. Configure an ASCII terminal to: 9.6 kbps, one start bit, eight data bits, no parity, one stop bit, no flow control, VT100 emulation
2. Connect the terminal to the local Vmux-2100 DB-9 CONTROL port.
3. Initiate the control session by entering the user name and password.
4. Verify that the main link card (M-IPE1) and the voice card (V-4E1) are identified by Vmux-2100 (**Main Menu > Inventory**).
5. Display the Host IP menu and enter the host IP address (172.17.15.10), its subnet mask and default gateway values (**Main Menu > Configuration > System > Management > Host IP**).
6. Repeat step 2 to step 5 for the Vmux-2100 unit to be installed at the remote location.

---

**Note** *The rest of the configuration procedure refers to the local unit. Information applicable to both units (or only to remote Vmux-2100) is explicitly identified.*

---

7. Display the Signal Profile Configuration menu, enter a desired signaling system profile number (1) and configure it according to the system used by the PBX connected to the V-4E1 card (**Main Menu > Configuration > System > Management > Signaling Configuration > Signaling Profile Configuration**).
8. Display the Hub menu and enter the existing main link card (M-IPE1) and the voice card (V-4E1) into the unit's database (**Main Menu > Configuration > Hub**).

## Configuring E1 Main Link Parameters

### ► Configuring the E1 main link parameters:

1. Display the Main Link menu, and configure the E1 main link parameters to the following values (**Main Menu > Configuration > Card > Main Board > E1 Parameters > Main Link 1**):
  - Connect – Yes
  - Frame – G.732N
  - Restoration – CCITT
  - Clock Source – Lbt
  - Interface Type – Dsu
  - Idle Code – 7E.
2. Display the Time Slot Table menu and assign the timeslots to carry data (**Main Menu > Configuration > Card > Main Board > E1 Parameters > Time Slot Table**):
  - **Yes** – connected (assigned)
  - **No** – disconnected (not assigned).

## Configuring Voice Card Parameters

### ► Configuring the voice card parameters:

1. Display the Group 1 menu, and assign the 172.17.15.11 IP address to the group 1 (**Main Menu > Configuration > Card > Slot 1 > Group 1**).
2. Display the Bundle Configuration menu, and add bundle 1 to the system (**Main Menu > Configuration > Card > Slot 1 > Group 1 > Bundles Parameters > Bundle Configuration**).
3. Display the Edit Bundle menu, and configure the group 1 bundle 1 parameters to the following values (**Main Menu > Configuration > Card > Slot 1 > Group 1 > Bundles Parameters > Bundle Configuration > Edit Bundle**):
  - Connect – Yes
  - Function – TDMoIP
  - Max Bytes In Multiplexed Frame – 500
  - Destination IP – 172.17.15.21
  - Destination Bundle – 1
  - Packetizing Interval – 30
  - Coder/Rate – G.723.1/6.4
  - Fax/Modem – Enable at 9.6 kbps.

4. Display the E1 Parameters menu, and set the E1 port of group 1 to the following values (**Main Menu > Configuration > Card > Slot 1 > Group 1 > External 1 > E1 Parameters**):
  - Connect – Yes
  - Frame – G.732S
  - Restoration – CCITT
  - Clock Source – Lbt
  - Interface Type –Dsu
  - Idle Code – 7E
  - Signaling – CAS
  - Profile – 1.
5. Display the Time Slot Configuration menu, and configure the timeslots belonging to the external port 1 of group 1 (**Main Menu > Configuration > Card > Slot 1 > Group 1 > External 1 > Distribution Of Framer Time Slots > Time Slot Configuration**):
  - Update from Time Slot – 1
  - To Time Slot – 31
  - Type – Voice
  - Bundle – 1
  - Destination Port ID – 1
  - Destination Time Slot ID – 1.

---

**Note** *Vmux-2100 displays timeslot 16 as 'Not Connected' (NC), because it carries CAS signaling information.*

---

6. Update the timeslot database from the Time Slot Configuration menu.
7. Repeat step 4 to step 6 for the external port 2 of group 1, except for the following:
  - Assign **2** to the Destination Port ID for the timeslots in step 5.
8. Display the Group 2 menu, and assign the 172.17.15.12 IP address to the group 2 (**Main Menu > Configuration > Card > Slot 1 > Group 2**).
9. Repeat step 3 to step 6 for the external port 1 of group 2, except for the following:
  - Assign destination IP 172.17.15.21 to the bundle 1 in step 2
  - Assign **3** to the Destination Port ID for the timeslots in step 5.
10. Repeat step 4 to step 6 for the external port 2 of group 2, except for the following:
  - Assign **4** to the Destination Port ID for the timeslots in step 5.

*Figure 5-2* summarizes the external E1 bundle and timeslot configuration of the local and remote units.

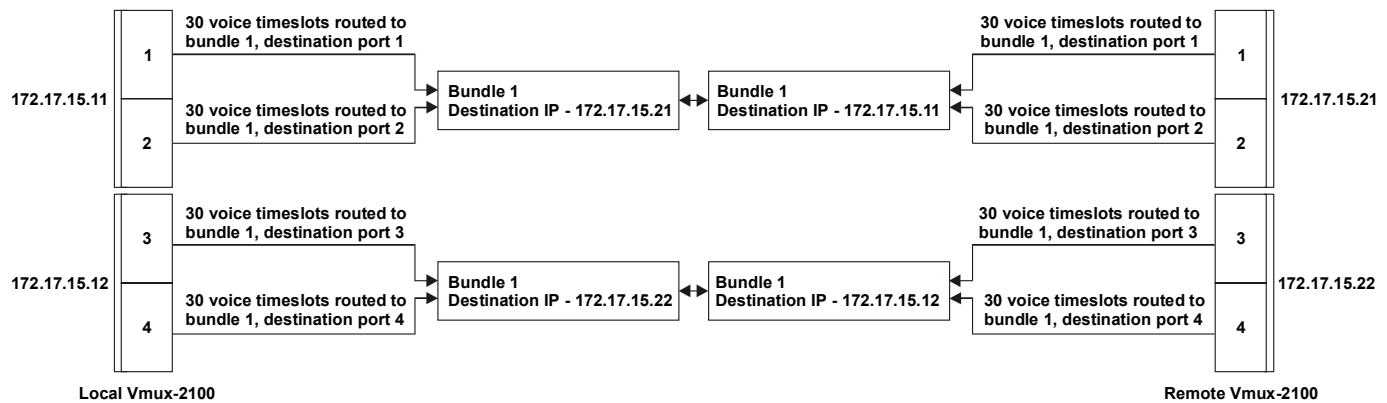


Figure 5-2. External E1 Bundle and Timeslot Configuration

## Transferring Database to the Remote Vmux-2100

### ► To transfer the database to the remote Vmux-2100:

1. Upload the **cnfg.dat** file from the local Vmux-2100 to the management station via the TFTP protocol.
2. Download the **cnfg.dat** file to the remote Vmux-2100 via the TFTP protocol.
3. Establish a Telnet connection.
4. Update the remote Vmux-2100 database by typing @.

**Note** The host IP and the main link values do not change when you download the new configuration and update the database.

## Completing Remote Vmux-2100 Configuration

The only difference between configurations of the local and remote units is the source and destination IP addresses of their bundles.

### ► To complete the remote Vmux-2100 configuration:

1. Display the Group 1 menu, and assign the 172.17.15.21 IP address to the group 1 (**Main Menu > Configuration > Card > Slot 1 > Group 1**).
2. Display the Group 2 menu, and assign the 172.17.15.22 IP address to the group 2 (**Main Menu > Configuration > Card > Slot 1 > Group 2**).
3. Display the Edit Bundle menu, and configure the group 1 bundle 1 destination IP to 172.17.15.11 (**Main Menu > Configuration > Card > Slot 1 > Group 1 > Bundles Parameters > Bundle Configuration > Edit Bundle**).
4. Display the Edit Bundle menu, and configure the group 2 bundle 1 destination IP to 172.17.15.12 (**Main Menu > Configuration > Card > Slot 1 > Group 2 > Bundles Parameters > Bundle Configuration > Edit Bundle**).

Now local and remote Vmux-2100 units are ready for operation.

---

## 5.4 Configuring Vmux-2100 for Operation with CCS Signaling

Configuration of the Vmux-2100 units operating with the CCS signaling is similar to the configuration for operation with the CAS signaling, except for the following:

1. From E1 Parameters menu, set the framing type of the external E1 links to G.732N (**Main Menu > Configuration > Card > Slot 1 > Group 1 > External 1 > E1 Parameters**).
2. From E1 Parameters menu, set the signaling type of the external E1 links to CCS (**Main Menu > Configuration > Card > Slot 1 > Group 1 > External 1 > E1 Parameters**).
3. Display the Time Slot Configuration menu, and configure the timeslots belonging to the external port 1 of group 1 (**Main Menu > Configuration > Card > Slot 1 > Group 1 > External 1 > Distribution Of Framer Time Slots > Time Slot Configuration**):
  - Update from Time Slot – 1
  - To Time Slot – 31
  - Type – Voice
  - Bundle – 1
  - Destination Port ID – 1
  - Destination Time Slot ID – 1.
4. Once you assign all timeslots belonging to the external port 1 of group 1 to carry voice, assign one of them (for example, timeslot 31) to carry signaling information:
  - Update from Time Slot – 31
  - To Time Slot – 31
  - Type – HDLC
  - Bundle – 1
  - Destination Port ID – 1
  - Destination Time Slot ID – 31.
5. Update the timeslot database from the Time Slot Configuration menu.
6. Repeat step 1 to step 4 for all active external ports on all Vmux-2100 slots.
7. When working with CCS-SS7, you can instruct Vmux-2100 to drop certain amount of fill-in signal units (FISUs) by selecting the appropriate SS7 keep-alive suppression rate (**Main Menu > Configuration > System > Management > Signaling Configuration > SS7 Keep-Alive Suppression Rate**).



# Chapter 6

---

## Diagnostics

This chapter describes the Vmux-2100 diagnostic functions, which include:

- Tone injection
- Loopbacks (local and remote)
- Ping utility.

---

### 6.1 Tone Injection

The test tone is a data sequence at a rate of 1 kHz. This data sequence is identical to the data sequence that would have been generated if a 1 kHz signal having a nominal level 0 dBm were applied to the input of the channel speech processor. The tone should be received clearly by the corresponding subscriber connected to the PBX at the nominal receive level. Vmux-2100 supports tone injection towards the local side only (see [Figure 6-1](#)).

The tone injection is activated individually per timeslot. However, multiple tone injections can be run at the same time. Vmux-2100 allows you to set the tone injection timeout causing the tone relay to deactivate automatically after the desired period of time.

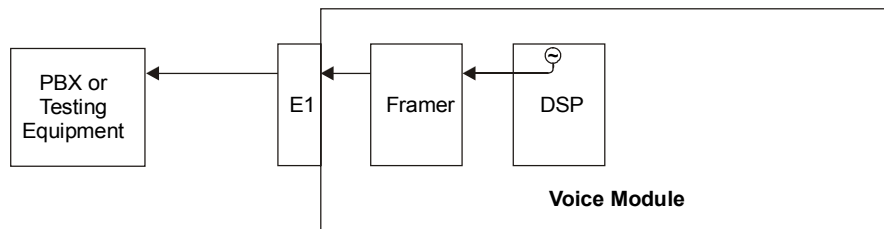


Figure 6-1. Local Tone Injection

---

**Note** Before performing tone injection, make sure that the timeslot to which you intend to inject the tone belongs to the properly configured E1/T1 port.

---

➤ **To activate tone injection:**

1. From the Main menu, choose **Diagnostics**.

The Diagnostics menu appears (see [Figure 6-2](#)).

```

Diagnostics
1. Inject Tone Test
2. Local Loop Test
3. Remote Loop Test
4. Display Active test
5. Ping

@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit

```

Figure 6-2. Diagnostics Menu

2. From the Diagnostic menu, choose **Inject Tone Test**.  
The Inject Tone Test menu appears (see [Figure 6-3](#)).

```

Inject Tone Test
1. Slot > (Slot 1)
2. Port > (Port 1)
3. Timeslot [1 - 31] (1)
4. Direction > (Local)
5. Time Out(seconds, 0=forever) [0 - 60]... (0)
6. Activate

@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit

```

Figure 6-3. Inject Tone Menu

3. From the Inject Tone Test menu, perform the following steps to complete the tone injection activation:
  - Select a desired slot.
  - Select a desired E1/T1.
  - Select a timeslot for the tone injection.
  - Specify direction of the tone injection:
    - **Local** (towards the local PBX, see [Figure 6-1](#))
  - Define the tone injection timeout (period of time after which the tone injection stops automatically):
    - **0** seconds (forever) to **60** seconds
  - Activate the tone injection by typing **6**, and selecting **Yes** from the displayed menu.
  - Repeat the procedure for all timeslots that you intend to test.

**Note** You can display information on all tests running at a time by selecting *Display Active Tests* from the *Diagnostics* menu.

## 6.2 Loopback Tests

Vmux-2100 supports activation of the local and remote loopbacks. The purpose of these tests is to determine the source of a break in the data flow. The loopbacks are activated per E1/T1 port.

### Local Loopback

Vmux-2100 can activate a local loopback to test the connection between the E1/T1 voice port and the local side PBX. In this mode, data coming from the PBX side is looped back (to the testing equipment). See [Figure 6-4](#).

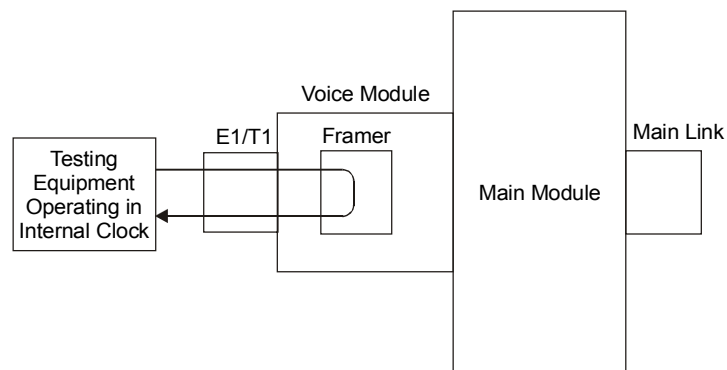


Figure 6-4. Local Loopback

► **To activate an local loopback:**

1. Configure the testing equipment to internal clock.
2. From the Diagnostics menu, choose **Local Loop Test**.

The Local Loop Test menu appears (see [Figure 6-5](#)).

```
Local Loop Test
1. Slot                               > (Slot 1)
2. Port                               > (Port 1)
3. Activate

@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

Figure 6-5. Local Loop Test Menu

3. From the Local Loop Test menu, perform the following steps to complete the local loopback activation:
  - Select a desired slot.
  - Select a desired port.
  - Activate the local loopback by choosing **Activate**, and then selecting **Yes** from the displayed menu.

## Remote Loopback

Vmux-2100 can activate a remote loopback to test internal connection between the E1/T1 voice port and the main link. In this mode, data coming from the network (E1/T1 or IP) is looped back to the network (to the remote side). See [Figure 6-6](#).

► **To activate a remote loopback:**

1. From the Diagnostics menu, choose **Remote Loop Test**.  
The Remote Loop Test menu appears (similar to the Local Loop Test menu shown in [Figure 6-5](#)).
2. From the Remote Loop Test menu, perform the following steps to complete the remote loopback activation:
  - Select a desired slot.
  - Select a desired port.
  - Activate the remote loopback by choosing **Activate**, and then selecting **Yes** from the displayed menu.

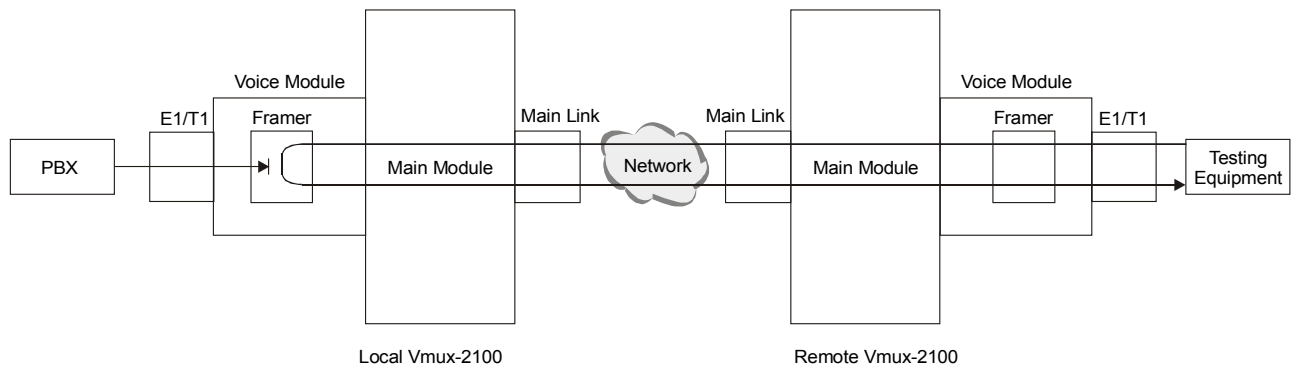


Figure 6-6. Remote Loopback

---

## 6.3 Pinging Remote Devices

The ping utility is used to confirm IP connectivity by pinging other IP hosts. The connectivity is confirmed by receiving a reply from the remote (pinged) hosts.

► **To ping a host:**

1. From the Diagnostics menu, choose **Ping**.  
The Ping menu appears (see [Figure 6-7](#)).

```
Ping
1. Ip Address      ... (0.0.0.0)
2. Number Of Pings [1 - 16]... (1)
3. Activate

@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

Figure 6-7. Ping Menu

2. From the Ping menu, choose **Ip Address**, and enter the desired host IP address.
3. From the Ping menu, choose **Number Of Pings**, and enter the number of pings.
4. From the Ping menu, choose **Activate** to activate the pinging.

---

## 6.4 Displaying the Active Tests

The Vmux-2100 management software allows you to display tone injection and loopbacks currently in progress.

➤ **To display all active tests:**

- From the Diagnostics menu, choose **Display Active Test**.

Vmux-2100 displays a list of active tests, specifying the exact slot, E1/T1 port and timeslot (for tone injection only).



# Chapter 7

---

## Monitoring and Statistics Collection

This chapter describes the alarms, sanity checks (configuration errors and warnings), main link and voice module statistics supported by Vmux-2100.

---

### 7.1 Alarms

Vmux-2100 detects fault conditions and initiates alarms and events to alert the user:

- **Alarms** (major and minor) have two statuses, ON and OFF. Alarm status changes to OFF, when a fault condition that caused it is cleared.
- **Events** have only ON status.

#### Alarm Buffer

Vmux-2100 maintains two alarm buffers:

- **Temporary buffer**, represented in the Display All Alarms screen. The user can delete all alarms, including the active ones from this display.
- **Permanent buffer**, represented in the Alarm Status screen. The user can delete only inactive alarms from the Alarm Status display.

An alarm enters simultaneously both Display All Alarms and Alarm Status logs, and the ALM LED turns on to indicate the condition. In addition, Vmux-2100 displays ALARM ON indication in the top right-hand corner of the terminal screen. When the event that caused the alarm is cleared, the alarm status changes to OFF, enabling the user to remove it from the permanent buffer.

#### Working with the Temporary Alarm Buffer

The temporary buffer is represented by the Display All Alarms screen.

➤ **To access the Display All Alarms screen:**

1. From the Main menu, choose **Monitoring**.  
The Monitoring menu appears.
2. From the Monitoring menu, choose **Status**.  
The Status menu appears (see [Figure 7-1](#)).

```
Status

1. Display
2. Clear
3. Display Sanity

@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

Figure 7-1. Status Menu

- From the Status menu, choose **Display**.

The Display menu appears (see [Figure 7-2](#)).

```
Display

1. Display All Alarms
2. Display & Clear Alarms
3. Display Alarm Status

@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

Figure 7-2. Display Menu

- From the Display menu, choose **Display All Alarms** to view the alarms.

Vmux-2100 displays the temporary alarm buffer (see [Figure 7-3](#)).

```
(047)          FAN No. 4 FAILURE                MAJOR  10-03-2001 01:50:16
(047)          FAN No. 4 FAILURE                OFF   10-03-2001 01:50:1
(20)           INTERNAL ERROR                   Event 10-03-2001 01:48:15

Press 'y' To Continue...
Press 'n' To Stop.

@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

Figure 7-3. Temporary Buffer (Display All Alarms Screen)

The display includes alarm identification code, its severity, status, and generation date and time.

The active alarms are indicated

➤ **To delete alarms from the temporary buffer:**

- From the Display menu, choose **Display & Clear Alarms** to view and then delete the current alarms.

Vmux-2100 displays the current alarms and deletes them from the buffer when the user exits the screen.



## Working with Permanent Buffer

The permanent buffer is represented by the Alarm Status screen.

➤ **To access the Alarm Status screen:**

- From the Display menu (see [Figure 7-2](#)), choose **Display Alarm Status**.

Vmux-2100 displays the permanent alarm buffer (see [Figure 7-4](#)).

```
(047)          FAN No. 4 FAILURE          MAJOR
(047)          FAN No. 4 FAILURE          OFF
(20)           INTERNAL ERROR             Event

Press 'y' To Continue...
Press 'n' To Stop.

@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

Figure 7-4. Permanent Buffer (Alarm Status Screen)

➤ **To delete inactive alarms from the permanent buffer:**

- From the Status menu (see [Figure 7-1](#)), choose **Clear**.

The Clear menu appears.

- Confirm the alarm deletion by choosing **Clear all Alarms**.

Vmux-2100 deletes all alarms in the OFF state and events from the permanent buffer.

[Table 7-1](#) lists the Vmux-2100 alarms according to their identification codes.

Table 7-1. Vmux-2100 Alarms

ID Code	Terminal Message	Description	Severity
18	DB UPDATE OCCURRED	Vmux-2100 database has been updated	Event
20	INTERNAL ERROR	Software error	Event
<b>Note:</b> The INTERNAL ERROR alarm is used for software debugging. To receive detailed description of each internal alarm, enable 'Open Internal Alarms' from the System menu ( <b>Main menu</b> > <b>Configuration</b> > <b>System</b> > <b>Open Internal Alarms</b> ).			
21	MODULE WAS REMOVED	A voice module installed in the specified slot has been removed	Event
22	MODULE WAS INSERTED	A voice module has been inserted from into a slot	Event
40	POWER SUPPLY No. 1 FAILURE	Power supply 1 failure has been detected	Major
41	POWER SUPPLY No. 2 FAILURE	Power supply 2 failure has been detected	Major
42	POWER SUPPLY NO. 1 WAS REMOVED	Power supply 1 has been removed from its slot	Major

Table 7-1. Vmux-2100 Alarms (Cont.)

ID Code	Terminal Message	Description	Severity
43	POWER SUPPLY NO. 2 WAS REMOVED	Power supply 2 has been removed from its slot	Major
44	FAN No.1 FAILURE	Fan 1 failure has been detected	Major
45	FAN No.2 FAILURE	Fan 2 failure has been detected	Major
46	FAN No.3 FAILURE	Fan 3 failure has been detected	Major
47	FAN No.4 FAILURE	Fan 4 failure has been detected	Major
67	MAIN LINK OVERFLOW	The required transmit bandwidth exceeds the actual main link throughput	Major
78	IO-X LOST CONNECTION WITH GR1	TCP connection between Group 1 of slot X and the main module has been lost	Major
79	IO-X LOST CONNECTION WITH GR2	TCP connection between Group 2 of slot X and the main module has been lost	Major
80	BPV ERROR HAS OCCURRED	A bipolar violation error has been detected E1/T1 port	Event
81	EXCESSIVE ERROR RATION	The bit error rate of the port exceeds $1 \times 10^{-3}$	Major
82	ALARM INDICATION SIGNAL	AIS is being detected at the E1/T1 port	Major
83	EXCESSIVE BIPOLAR VIOLATION	Excessive BPVs at the E1/T1 port	Major
84	T1/E1 FRAME SLIP HAS OCCURRED	A frame slip at the E1/T1 port	Event
87	T1/E1 SIGNAL LOSS	Loss of input signal at the E1/T1 port	Major
88	AIS RED ALARM	Local loss of frame synchronization at the T1 port caused by AIS condition	Major
89	LOC SYNC LOSS (RED ALARM)	Local loss of frame synchronization at the E1/T1 port	Major
90	REM SYNC LOSS (YELLOW ALARM)	Remote loss of frame synchronization at the E1/T1 port	Major
92	NETWORK LLB	Line loopback command is received from the network at the T1 port	Minor
93	NETWORK PLB	Payload loopback command is received from the network at the T1 port	Minor
97	LOCAL MULTIFRAME ALARM	Local loss of multiframe synchronization at the E1 port	Minor
98	REMOTE MULTIFRAME ALARM	Remote loss of multiframe synchronization at the E1 port	Minor
100	CRC ERROR OCCURRED	CRC-4 error in the E1 port receive signal	Minor
195	BUNDLE IS OOS	Bundle is out of service due to network problems	Major

---

## 7.2 Sanity Checks

Configuration errors and mismatches are rendered by the Vmux-2100 management software as sanity checks. Their main purpose is to maintain the database validity. Vmux-2100 supports two types of the sanity check messages:

- **Error** – major configuration error which prevents the Vmux-2100 database from updating and saving changes.
- **Warning** – minor configuration error which allows the user to update the database and save the changes.

### Displaying the Sanity Errors and Warnings

Each time you update the Vmux-2100 database, the management software analyses the changes. If a major error is detected, Vmux-2100 aborts the database update and displays the following message:

**Data base wasn't changed. Sanity Error - Check alarm.**

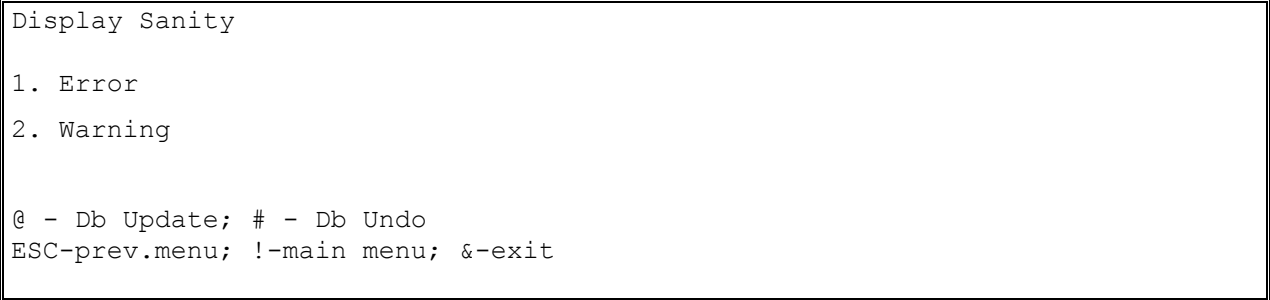
If a minor error is detected, Vmux-2100 updates the database and displays the following message:

**Sanity Warning - Check alarm.**

➤ **To display the sanity errors and warnings:**

1. From the Status menu (see [Figure 7-1](#)), choose **Display Sanity**.

The Display Sanity menu appears (see [Figure 7-5](#)).



```
Display Sanity

1. Error
2. Warning

@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

*Figure 7-5. Display Sanity Menu*

2. From the Display Sanity menu, choose **Error** to display the sanity errors or choose **Warning** to display the sanity warnings.

The sanity error or warning list is displayed.

## Sanity Error and Warning List

[Table 7-2](#) lists in alphabetical order all sanity errors and warnings generated by Vmux-2100.

*Table 7-2. Sanity Errors and Warnings*

Display	Type	Description
BUNDLE IS NOT CONNECTED	Warning	A timeslot is assigned to a bundle which is not connected
CARD DOES NOT EXIST IN SLOT	Warning	A voice card configured in the database is missing from a slot
CARD EXISTS IN SLOT	Warning	A voice card installed in a Vmux-2100 slot is not configured in the database (the Hub menu).
CARD TYPE MISMATCH	Warning	A mismatch between a voice card or main link card installed in Vmux-2100 and its type configured in the database.
CCS TS NOT RELATED TO THE SAME BUNDLE	Error	At least two timeslots of the E1/T1 port with the CCS signaling are assigned to different bundles. To avoid it, assign all timeslots of the same E1/T1 port with the CCS signaling to the same bundle.
CCS TS NOT RELATED TO THE SAME SLOT	Error	At least two timeslots of the E1/T1 port with the CCS signaling are assigned to different destination slots. To avoid it, assign all timeslots of the same E1/T1 port with the CCS signaling to the same destination slot.
CODER PROBLEM	Error	Conflict in the DSP capacity and timeslot configuration. Since each DSP handles six timeslots, every six consecutive timeslots must be configured to use the same voice compression method.
CONNECTIVITY VALUES MUST BE THE SAME FOR ALL GROUP BUNDLES	Error	Connectivity values of all bundles which belong to the same group (have the same source IP) must be the same.
DISCONNECT BUNDLE BEFORE CHANGING CODER RATE	Error	Voice compression type was changed for a connected bundle. A mismatch between a voice compression type of an active local bundle and that of the destination bundle may cause problems at a DSP. To avoid this, do the following: <ol style="list-style-type: none"> <li>1. Disconnect a bundle of the local Vmux-2100.</li> <li>2. Disconnect destination bundle of the remote Vmux-2100.</li> <li>3. Change the voice compression method for both bundles.</li> <li>4. Reconnect the bundles.</li> </ol>
DOUBLE ROUTE	Error	More than one timeslot is connected to the same destination timeslot
E1/T1 NOT THE SAME FRAME TYPE	Error	E1/T1 ports of the same group are configured to the different framing modes
EMPTY ADMINISTRATOR LIST	Error	The last administrator account is deleted from the user database.
EXTERNAL NOT CONNECTED	Warning	A timeslot is assigned to an E1/T1 port which is not connected

Table 7-2. Sanity Errors and Warnings (Cont.)

Display	Type	Description
ILLEGAL DESTINATION IP ADDRESS	Error	Destination IP address for a bundle is not defined
ILLEGAL SOURCE IP ADDRESS	Error	A group IP address is illegal or not defined
<b>Note:</b> The following IP addresses are reserved for the main and voice card internal communication and cannot be assigned by the user: 1.1.1.255 and 1.1.1.0 to 1.1.1.8.		
TS INCOMPATIBLE WITH E1 TYPE	Error	Timeslot 16 is configured to HDLC when E1 is set to the G.732S framing mode. Timeslot 16 configuration must be changed to not connected
TOO MANY CONFIGURED TS	Error	Number of timeslots assigned to carry voice exceeds the number of timeslots supported by the unit
TS 16 SHOULD BE DISCONNECTED IN CAS MODE	Error	Timeslot 16 is configured to Voice when operating Vmux-2100 with CAS signaling. Timeslot 16 configuration must be changed to not connected

## 7.3 Collecting Statistics

This section explains how to display performance data collected on the Vmux-2100 main link and E1/T1 groups.

### Displaying Statistics on the Main Link Ports

Vmux-2100 evaluates performance of the 10/100BaseT port and calculates the main card CPU utilization.

#### Collecting the Main Link Ethernet Statistics

- **To display the main link Ethernet statistics:**
  - From the Main menu, choose **Monitoring**.  
The Monitoring menu appears.
  - From the Monitoring menu, choose **Statistics**.  
The Statistics menu appears (see [Figure 7-6](#)).

```
Statistics
1. Cards statistics
2. Main Module statistics

@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

Figure 7-6. Statistics Menu

- From the Statistics menu, choose **Main Module statistics**.  
The Main Module Statistics menu appears (see [Figure 7-7](#)).

```

Main Module Statistics
1. Cpu Utilization
2. Ethernet statistics
3. Hdlc statistics*

@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit

```

Figure 7-7. Main Module Statistics Menu

4. From the Main Module Statistics menu, choose **Ethernet statistics**.
5. From the Ethernet Statistics menu, choose **Display** to display the main link Ethernet statistics.

*Figure 7-8* illustrates the Ethernet statistics screen. *Table 7-3* describes the statistics values.

```

Ethernet Statistics.
Rx statistics
Total Frames: [          359540]    Total Bytes: [          47587419]
      Frames: [          31424]        Bytes: [          3704499]
Brdcst Frames: [          27767]    Multcst Frames:[          2533]
Tx statistics
      Frames: [           675]        Bytes: [          78120]
Brdcst Frames: [           17]    Multcst Frames:[           0]
Frame sizes statistics (Rx+Tx)
      64b: [          56127]        65b-127b: [          169767]
      128b-255b: [          115637]    256b-511b: [           8937]
      512b-1023b: [           2245]    1024b-max: [           5451]
Rx Errors statistics
Undersize: [           0]    Oversize: [           0]
      CRC: [           0]    Fragments: [          2052]
Collision: [           1]    Late Collision: [           0]
      Jabber: [           0]    Dropped: [           0]

Press 'Y' for refresh , ESC - for exit.
ESC-prev.menu; !-main menu; &-exit

```

Figure 7-8. Main Link Ethernet Statistics Screen

Table 7-3. Main Link Ethernet Statistics Values

Field	Description
Rx Total Frames	Total number of packets received
Rx Total Bytes	Total number of data octets of all packets received
<b>Note:</b> A data octet is a single byte from the packet data section	
Rx Frames	Number of good packets received
Rx Bytes	Number of data octets of good packets received
Rx Brdcst Frames	Number of good broadcast packets received
Rx Multcst Frames	Number of good multicast packets received
Tx Frames	Number of good packets transmitted

Table 7-3. Main Link Ethernet Statistics Values (Cont.)

Field	Description
Tx Bytes	Number of data octets of good packets transmitted
Tx Brdcast Frames	Number of good broadcast packets transmitted
Tx Multcast Frames	Number of good multicast packets transmitted
Frames 64b	Number of received and transmitted packets with size of 64 bytes
Frames 65b-127b	Number of received and transmitted packets with size of 65 to 127 bytes
Frames 128b-255b	Number of received and transmitted packets with size of 65 to 127 bytes
Frames 256b-511b	Number of received and transmitted packets with size of 256 to 511 bytes
Frames 512b-1023b	Number of received and transmitted packets with size of 512 to 1023 bytes
Frames 1024b-max	Number of received and transmitted packets with size of 1024 to 1518/1536 bytes
Rx Undersize	Number of received packets which meet the following conditions: <ul style="list-style-type: none"> <li>• Packet data length is less than 64 bytes</li> <li>• Collision event has not been detected</li> <li>• Late collision event has not been detected</li> <li>• Packet has valid CRC</li> </ul>
Rx Oversize	Number of received packets which meet the following conditions: <ul style="list-style-type: none"> <li>• Packet data length equals or is greater than 1518/1536 bytes</li> <li>• Packet has valid CRC</li> </ul>
Rx CRC	Number of received packets which meet the following conditions: <ul style="list-style-type: none"> <li>• Packet data length is between 64 and 1518/1536 bytes</li> <li>• Packet has invalid CRC</li> <li>• Collision event has not been detected</li> <li>• Late collision event has not been detected</li> </ul>
Rx Fragments	Number of received packets which meet the following conditions: <ul style="list-style-type: none"> <li>• Packet data length is less than 64 bytes</li> <li>• Packet has invalid CRC</li> <li>• Collision event has not been detected</li> <li>• Late collision event has not been detected</li> </ul>
Rx Collision	Number of received packets with collision event detected
Rx Late Collision	Number of received packets with late collision event detected
Jabber	Number of received packets which meet the following conditions: <ul style="list-style-type: none"> <li>• Packet data length is greater than 1518/1536 bytes</li> <li>• Packet has invalid CRC</li> </ul>
Dropped	Number of received dropped packets

➤ **To clear the main port Ethernet statistics:**

- From the Ethernet Statistics menu, choose **Clear** to reset the Ethernet performance registers.

### Collecting the Main Link HDLC Statistics

If the Vmux-2100 unit is equipped with an E1 or T1 main link, the HDLC Statistics option line will appear on the Main Module Statistics menu (see [Figure 7-7](#))

➤ **To display the main link HDLC statistics:**

1. Choose **HDLC statistics**
2. From the HDLC Statistics menu, choose **Display** to display the main link HDLC statistics.

[Figure 7-9](#) illustrates the Ethernet statistics screen. [Table 7-4](#) describes the HDLC statistics values.

HDLC Statistics			
Rx statistics			
Total Frames	: [ 33257592 ]	Total Bytes	: [ 222811066 ]
BSY Error	: [ 71 ]	GLITCH Error	: [ 0 ]
DE Error	: [ 0 ]	LG Error	: [ 0 ]
NO Error	: [ 1281 ]	AB Error	: [ 1290 ]
CR Error	: [ 306 ]	OV Error	: [ 0 ]
Tx statistics			
Total Frames	: [ 31103898 ]	Total Bytes	: [ 41353332 ]
UNDERRUN Error	: [ 0 ]	GLITCH Error	: [ 0 ]
Bandwidth To TDM - Average: [ 32616] Max : [ 153744] (bit/Sec)			
Bandwidth To Line- Average: [ 33696] Max : [ 156568] (bit/Sec)			
Tx Queue			
Max Frames	: [ 0 ]	Current Frames	: [ 0 ]
Free Frames	: [ 0 ]		
Press 'Y' for refresh , ESC - for exit.			
ESC-prev.menu; !-main menu; &-exit			

Figure 7-9. Main Link HDLC Statistics Screen



Table 7-4. Main Link HDLC Statistics Values

Field	Description
Rx Total Frames	Total number of HDLC packets received
Rx Total Bytes	Total number of data octets of all packets received
Rx BSY Error	Number of received HDLC packets discarded due to lack of buffer resources (buffer is busy)
Rx Glitch Error	Number of clock glitches in the received packets
Rx DE Error	Number of packets received containing DPLL errors
Rx LG Error	Number of packets received with frame length violations
Rx NO Error	Number of non-octet aligned packets received
Rx AB Error	Number of packets received with abort sequence violations (7 or more consecutive ones)
Rx CR Error	Number of packets received containing CRC errors
Rx OV Error	Number of overrun errors in the received packets
Tx Total Frames	Total number of HDLC packets transmitted
Tx Total Bytes	Total number of data octets of all packets transmitted
Tx Underrun Error	Number of transmitted HDLC packets discarded due to lack of buffer resources
Tx Glitch Error	Number of clock glitches in the transmitted packets
Tx Bandwidth to TDM – Average	Average TDM bandwidth transmitted during last 12 minutes (or since last clear)
Tx Bandwidth to TDM – Max	Peak TDM bandwidth transmitted during last 12 minutes (or since last clear)
Tx Bandwidth to Line – Average	Average bandwidth transmitted on the line (adds HDLC flags and CRC to TDM bandwidth) during last 12 minutes (or since last clear)
Tx Bandwidth to Line – Max	Peak bandwidth transmitted on the line (adds HDLC flags and CRC to TDM bandwidth) during last 12 minutes (or since last clear)
Tx Queue – Max Frames	Peak number of packets waiting in the buffer to be transmitted (since the last clear)
Tx Queue – Current Frames	Current number of packets waiting in the buffer to be transmitted
Tx Queue – Free Frames	Number of packets that were discarded due to lack of buffer resources (since last clear)

### Calculating the Main Card CPU Utilization

When calculating the CPU utilization, Vmux-2100 displays the following values:

- Current CPU utilization
- Maximum utilization of the CPU resources ever registered by the management software.

➤ **To calculate the main card CPU utilization:**

1. From the Main Module Statistics menu, choose **Cpu Utilization**.
2. From the CPU Utilization menu, choose **Display** to display the CPU utilization statistics (see [Figure 7-10](#)) or **Clear** to clear the registers.

```
CPU Utilization  :[ 5 %    ]   Max CPU Utilization  :[ 70 %      ]  
Press Any Key To Continue...  
  
@ - Db Update; # - Db Undo  
ESC-prev.menu; !-main menu; &-exit
```

*Figure 7-10. Main Card CPU Utilization Statistics*

### Displaying Statistics on the E1/T1 Groups

Vmux-2100 supports statistics collection of the voice E1/T1 group performance. Statistics are accessed via the Cards Statistics menu.

➤ **To display the Card Statistics menu:**

- From the Statistics menu (see [Figure 7-6](#)), choose **Cards statistics**.

The Cards Statistics menu appears (see [Figure 7-11](#)).

```
Cards Statistics  
  
1. Ethernet statistics  
2. HDLC statistics  
3. Memory statistics  
4. Bundles statistics  
5. Voice statistics  
6. Voice Rx Signaling statistics  
7. Voice Tx Signaling statistics  
8. Cpu Utilization  
  
@ - Db Update; # - Db Undo  
ESC-prev.menu; !-main menu; &-exit
```

*Figure 7-11. Cards Statistics Menu*

## Displaying E1/T1 Group Ethernet Statistics

Each E1/T1 group and main link card of Vmux-2100 is connected to an internal Ethernet bus used for the data transmission between the modules. Vmux-2100 evaluates the Ethernet traffic taking place between an E1/T1 group and the bus (see [Figure 7-14](#)). [Table 7-5](#) describes the Ethernet statistics values.

► **To display the E1/T1 group Ethernet statistics:**

1. From the Cards Statistics menu, choose **Ethernet statistics**.

The E1/T1 group Ethernet Statistics menu appears (see [Figure 7-12](#)).

```
Ethernet Statistics

1. Slot>      (Slot 1)
2. Group Number >  (Group 1)
3. Mode

@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

*Figure 7-12. E1/T1 Group Ethernet Statistics Menu*

2. From the Ethernet Statistics menu, choose **Slot>** and then enter the desired slot number from the displayed list to select the slot.
3. From the Ethernet Statistics menu, choose **Group Number>** and then enter the desired group number from the displayed list to select the group.
4. From the Ethernet Statistics menu, choose **Mode**.

The Mode menu appears (see [Figure 7-13](#)).

```
Mode

1. Clear
2. Display

@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

*Figure 7-13. Mode Menu*

5. From the Mode menu, menu, choose **Display** to display the E1/T1 group Ethernet statistics (see [Figure 7-14](#)) or **Clear** to clear the statistics registers.

```

Ethernet Statistics of Slot      2, Group      1
                               Rx statistics

Total Frames   :[      919545]      Total Bytes   :[      96236506]
60 sec Frames  :[         837]      60 sec Bytes   :[         139349]
LG Error :[          0]      NO Error  :[          0]      SH Error :[          0]
OV Error :[          0]      Nlb Error :[          0]      CR Error :[          0]

                               Tx statistics

Total Frames   :[         5392]      Total Bytes   :[         343236]
60 sec Frames  :[           6]      60 sec Bytes   :[           376]
Lc Error :[          0]      Rl Error  :[          0]
Un Error :[          0]      Csl Error :[          0]      Nlb Error:[          0]

Tx Queue - Max Frames   :[          0]      Current Frames :[          0]
Rx Queue - Max Frames   :[          0]      Current Frames :[          0]
PPS      - Rx           :[          29]      Tx              :[          0]

ESC-prev.menu; !-main menu; &-exit

```

Figure 7-14. E1/T1 Group Ethernet Statistics Screen

Table 7-5. E1/T1 Group Ethernet Statistics Values

Field	Description
Rx Total Frames	Total number of packets received
Rx Total Bytes	Total number of data octets of all packets received
Rx 60 sec Frames	Number of packets received during last 60 seconds
Rx 60 sec Bytes	Number of data octets received during last 60 seconds
Rx LG Error	Number of long packets received (longer than 2047 bytes)
Rx NO Error	Number of non-octet aligned packets received
Rx SH Error	Number of short packets received (shorter than the minimum defined for this channel)
Rx OV Error	Number of overrun errors in the received packets
Rx Nlb Error	Number of errors in the received packets caused by no alignment on octets, usually due to glitch in clock
Rx CR Error	Number CRC errors in the received packets
Tx Total Frames	Total number of packets transmitted
Tx Total Bytes	Total number of data octets of all packets transmitted
Tx 60 sec Frames	Number of packets transmitted during last 60 seconds
Tx 60 sec Bytes	Number of data octets transmitted during last 60 seconds
Tx Lc Error	Number of late collision events in the transmitted packets
Tx RI Error	Number of retransmission events in the transmitted packets
Tx Un Error	Number of underrun events in the transmitted packets
Tx Csl	Number of carrier sense lost events in the transmitted packets
Tx Nlb Error	Number of errors in the transmitted packets caused by no alignment on octets, usually due to glitch in clock
Tx Queue - Max Frames	Maximum number of the transmitted packets ever accumulated in the FIFO buffer
Current Frames	Current number of the transmitted packets in the FIFO buffer
Rx Queue - Max Frames	Maximum number of the received packets ever accumulated in the FIFO buffer
Current Frames	Current number of the received packets in the FIFO buffer
PPS Rx	Transmit rate (in packets per second)
PPS Rx	Receive rate (in packets per second)

### Displaying E1/T1 Group HDLC Statistics

When the E1/T1 timeslots are configured to carry the HDLC data, Vmux-2100 collects HDLC traffic statistics (see [Figure 7-15](#)). [Table 7-6](#) describes the HDLC statistics values.

► **To display the E1/T1 group HDLC statistics:**

1. From the Cards Statistics menu , choose **HDLC statistics**.
2. From the HDLC Statistics menu, choose **Slot>** and then enter the desired slot number from the displayed list to select the slot.

- From the HDLC Statistics menu, choose **Group Number>** and then enter the desired group number from the displayed list to select the group.
- From the HDLC Statistics menu, choose **Mode**.  
The Mode menu appears (see [Figure 7-13](#)).
- From the Mode menu, menu, choose **Display** to display the E1/T1 group HDLC statistics (see [Figure 7-15](#)) or **Clear** to clear the statistics registers.

Hdlc Statistics on Slot 2 Port 1									
Rx statistics									
Total Frames	:	[	0]	Total Bytes	:	[	0]		
60 sec Frames	:	[	0]	60 sec Bytes	:	[	0]		
Glitch	:	[	0]	BSY	:	[	0]		
Tx statistics									
Total Frames	:	[	0]	Total Bytes	:	[	0]		
60 sec Frames	:	[	0]	60 sec Bytes	:	[	0]		
Glitch	:	[	0]	Underrun	:	[	0]		
Tx Queue - Max Frames		:	[	0]	Current Frames	:	[	0]	]
Free Frames		:	[	0]					

Figure 7-15. E1/T1 Group HDLC Statistics Screen

Table 7-6. E1/T1 Group HDLC Statistics Values

Field	Description
Rx Total Frames	Total number of HDLC packets received
Rx Total Bytes	Total number of data octets of all packets received
Rx 60 sec Frames	Number of HDLC packets received during last 60 seconds
Rx 60 sec Bytes	Number of data octets received during last 60 seconds
Rx Glitch	Number of clock glitches in the received packets
Rx BSY	Number of received HDLC packets discarded due to lack of buffer resources (buffer is busy)
Tx Total Frames	Total number of HDLC packets transmitted
Tx Total Bytes	Total number of data octets of all packets transmitted
Tx 60 sec Frames	Number of HDLC packets transmitted during last 60 seconds
Tx 60 sec Bytes	Number of data octets transmitted during last 60 seconds
Tx Glitch	Number of clock glitches in the transmitted packets
Tx Underrun	Number of transmitted HDLC packets discarded due to lack of buffer resources
Tx Queue - Max Frames	Maximum number of the transmitted HDLC packets ever accumulated in the FIFO buffer
Current Frames	Current number of the transmitted HDLC packets in the FIFO buffer
Free Frames	Number of frames discarded due to FIFO buffer overflow

## Displaying the E1/T1 Group Memory Statistics

Vmux-2100 estimates the number of free memory blocks (2000 bytes each) left in the E1/T1 group RAM (see [Figure 7-16](#)):

- **Start Blocks** – Number of free memory blocks after the startup
- **Current Blocks** – Number of free memory blocks available at the moment
- **Min. Blocks** – Minimum number of free memory blocks ever registered by the Vmux-2100 management software.

### ► To display the E1/T1 group memory statistics:

1. From the Cards Statistics menu (see [Figure 7-11](#)), choose Memory Statistics.
2. From the Memory Statistics menu, choose **Slot>** and then enter the desired slot number from the displayed list to select the slot.
3. From the Memory Statistics menu, choose **Group Number>** and then enter the desired group number from the displayed list to select the group.
4. From the Memory Statistics menu, choose **Display** to display the E1/T1 group memory statistics (see [Figure 7-16](#)).

Memory Statistics on Slot 2, Group 1			
Start blocks	: [ 2663 ]	Current blocks	: [ 1817 ]
Min blocks	: [ 1748 ]		

Figure 7-16. E1/T1 Group Memory Statistics Screen

## Displaying Bundle Statistics

The Vmux-2100 software enables you to evaluate performance of an individual bundle (see [Figure 7-17](#)). [Table 7-7](#) describes the bundle statistics values.

The bundles may have one of the following statuses:

- **Connect** – The bundle is connected
- **Disconnected** – The bundle is disconnected
- **Echo Wait** – There is physical connection, but remote bundle is not active.
- **IP OOS** – There is no physical connection between bundles. The reason for that can be an illegal IP address of the destination E1/T1 group.

► **To display the bundle statistics:**

1. From the Cards Statistics menu, choose **Bundles statistics**.
2. From the Bundle Statistics menu, choose **Slot>** and then enter the desired slot number from the displayed list to select the slot.
3. From the Bundle Statistics menu, choose **Group Number>** and then enter the desired group number from the displayed list to select the group.
4. From the Bundle Statistics menu, choose **Bundle Number** and then enter the desired bundle number (from **1** to **5**) to select the bundle.
5. From the Bundle Statistics menu, choose **Mode**.

The Mode menu appears (see [Figure 7-13](#)).

6. From the Mode menu, menu, choose **Display** to display the selected E1/T1 group bundle statistics (see [Figure 7-17](#)) or **Clear** to clear the statistics registers.

Statistics on Slot: 2, Group: 1, Bundle: 1, State: CONNECT											
Rx statistics											
Total Frames	:	[	0]	Total Bytes	:	[	0]				
60 sec Frames	:	[	0]	60 sec Bytes	:	[	0]				
Tx statistics + Type											
Total Frames	:	[	0]	Total Bytes	:	[	0]				
60 sec Frames	:	[	0]	60 sec Bytes	:	[	0]				
Tx on Timeout	:	[	0]	Tx Max size	:	[	0]				
60 sec Timout	:	[	0]	60 sec Max Size	:	[	0]				
Data Type											
Total - Rx Sg	:	[	0]	Rx Voice	:	[	0]	Rx Hdclc	:	[	0]
60 sec- Rx Sg	:	[	0]	Rx Voice	:	[	0]	Rx Hdclc	:	[	0]
Total - Tx Sg	:	[	0]	Tx Voice	:	[	0]	Tx Hdclc	:	[	0]
60 sec- Tx Sg	:	[	0]	Tx Voice	:	[	0]	Tx Hdclc	:	[	0]
Bundle Memory - Min Frames	:	[	120]	Current Frames	:	[	120]				
Silence percent on bundle - Rx:	:	[	100 ]	Tx	:	[	100 ]				

Figure 7-17. Bundle Statistics

Table 7-7. E1/T1 Group Bundle Statistics Values

Field	Description
Rx Total Frames	Total number of packets received
Rx Total Bytes	Total number of data octets of all packets received
Rx 60 sec Frames	Number of packets received during the last 60 seconds
Rx 60 sec Bytes	Number of data octets received during the last 60 seconds
Tx Total Frames	Total number of HDLC packets transmitted
Tx Total Bytes	Total number of data octets of all packets transmitted
Tx 60 sec Frames	Number of HDLC packets transmitted during the last 60 seconds
Tx 60 sec Bytes	Number of data octets transmitted during the last 60 seconds
Tx on Timeout	Number of packets transmitted as a result of reaching the maximum packetizing interval



Table 7-7. E1/T1 Group Bundle Statistics Values (Cont.)

Field	Description
Tx Max Size	Number of packets transmitted as a result of reaching the maximum frame size
60 sec Timeout	Number of packets transmitted as a result of reaching the maximum packetizing interval during the last 60 seconds
60 sec Max Size	Number of packets transmitted as a result of reaching the maximum frame size during the last 60 seconds
Total - Rx Sg	Total number of received signaling bits
Total - Rx Voice	Total number of received voice bits
Total - Rx Hdlc	Total number of received HDLC bits
60 sec - Rx Sg	Number of signaling packets received during last 60 seconds
60 sec - Rx Voice	Number of voice packets received during last 60 seconds
60 sec - Rx Hdlc	Number of HDLC packets received during last 60 seconds
Total - Tx Sg	Total number of transmitted signaling bits
Total - Tx Voice	Total number of transmitted voice bits
Total - Tx Hdlc	Total number of transmitted HDLC bits
60 sec - Tx Sg	Number of signaling packets transmitted during last 60 seconds
60 sec - Tx Voice	Number of voice packets transmitted during last 60 seconds
60 sec - Tx Hdlc	Number of HDLC packets transmitted during last 60 seconds
Bundle Memory - Min Frames	Minimum number of frames assigned for the current bundle
Current Frames	Current number of frames assigned for the current bundle
Silence percent on bundle – Rx	Average percentage of silence on all the received timeslots connected to the bundle
Silence percent on bundle – Tx	Average percentage of silence on all the transmitted timeslots connected to the bundle

### Displaying Timeslot Voice Statistics

The Vmux-2100 software enables you to evaluate performance of an individual timeslot as well as the performance of the DSP it uses (see [Figure 7-18](#)). [Table 7-8](#) describes the timeslot voice statistics values.

► **To display the timeslot voice statistics:**

1. From the Cards Statistics menu, choose **Voice Statistics**.
2. From the Voice Statistics menu, choose **Slot>** and then enter the desired slot number from the displayed list to select the slot.
3. From the Voice Statistics menu, choose **Port>** and then enter the desired port number from the displayed list to select the port
4. From the Voice Statistics menu, choose **Time Slot**, and then enter the number (from **1** to **31** for E1, or **1** to **24** for T1 ports) of the desired voice timeslot.

- From the Voice Statistics menu, choose **Mode**.

The Mode menu appears (see [Figure 7-13](#)).

- From the Mode menu, menu, choose **Display** to display the selected timeslot voice statistics (see [Figure 7-18](#)) or **Clear** to clear the statistics registers.

Voice Statistics on Slot: 2, Port: 1, Time Slot: 1			
Dsp Mode	:	[ IDLE ]	
Total Rx Voice	:	[ 0 ]	Total Tx Voice : [ 0 ]
Total Rx Sid	:	[ 0 ]	Total Tx Sid : [ 0 ]
Total Rx Fax	:	[ 0 ]	Total Tx Fax : [ 0 ]
Total Rx Data	:	[ 0 ]	Total Tx Data : [ 0 ]
Total Underun	:	[ 0 ]	Total Overrun : [ 0 ]
Max jitter len	:	[ 150 ]	
Silence percent since last clear: Rx: [ 99 ] Tx: [ 99 ]			

Figure 7-18. Timeslot Voice Statistics Screen

Table 7-8. Timeslot Voice Statistics Values

Field	Description
DSP Mode	<ul style="list-style-type: none"> <li>• IDLE – DSP is idle</li> <li>• VOICE – DSP is transmitting voice packets</li> <li>• DATA – DSP is transmitting HDLC packets</li> <li>• FAX –DSP is relaying fax signal</li> <li>• VOICEBAND – DSP is transmitting voiceband data (modem)</li> </ul>
Total Rx Voice	Total number of voice packets received from the DSP
Total Rx Sid	Total number of silence packets received from the DSP
Total Rx Fax	Total number of fax packets received from the DSP
Total Rx Data	Total number of HDLC packets received from the DSP
Total Tx Voice	Total number of voice packets transmitted to the DSP
Total Tx Sid	Total number of silence packets transmitted to the DSP
Total Tx Fax	Total number of fax packets transmitted to the DSP
Total Tx Data	Total number of HDLC packets transmitted to the DSP
Total Underun	Total underrun of the jitter buffer (in packets)
Total Overun	Total overrun of the jitter buffer (in packets)
Max jitter len	Max length of the jitter buffer (in msec)
Silence percent since last clear: Rx	Average percentage of silence carried by the received timeslot since buffer was last cleared
Silence percent since last clear: Tx:	Average percentage of silence carried by the transmitted timeslot since buffer was last cleared

## Displaying the Voice Signaling Statistics

When operating with the CAS signaling, Vmux-2100 transmits signaling information in one of the timeslots. You can display the mapping of the ABCD bits used by the each timeslot inside the signaling timeslot (see [Figure 7-19](#) and [Figure 7-20](#)).

- **Rx signaling** – Signaling transmitted from the DSP
- **Tx signaling** – Signaling transmitted towards the DSP.

### ► To display the timeslot voice statistics:

1. From the Cards Statistics menu, choose **Voice Rx Signaling statistics** to display Rx Signaling or choose **Voice Tx Signaling statistics**.
2. From the Voice Rx/Tx Signaling Statistics menu, choose **Slot>** and then enter the desired slot number from the displayed list to select the slot.
3. From the Voice Rx/Tx Signaling Statistics menu, choose **Group Number>** and then enter the desired group number from the displayed list to select the group.
4. From the Voice Rx/Tx Signaling Statistics menu, choose **Display** to display the statistics.

Voice Rx Signaling Statistics on Slot: 2, Port: 1														
Ts1	:	[	0000	]	Ts2	:	[	0000	]	Ts3	:	[	0000	]
Ts4	:	[	0000	]	Ts5	:	[	0000	]	Ts6	:	[	0000	]
Ts7	:	[	0000	]	Ts8	:	[	0000	]	Ts9	:	[	0000	]
Ts10	:	[	0000	]	Ts11	:	[	0000	]	Ts12	:	[	0000	]
Ts13	:	[	0000	]	Ts14	:	[	0000	]	Ts15	:	[	0000	]
Ts17	:	[	0000	]	Ts18	:	[	0000	]	Ts19	:	[	0000	]
Ts20	:	[	0000	]	Ts21	:	[	0000	]	Ts22	:	[	0000	]
Ts23	:	[	0000	]	Ts24	:	[	0000	]	Ts25	:	[	0000	]
Ts26	:	[	0000	]	Ts27	:	[	0000	]	Ts28	:	[	0000	]
Ts29	:	[	0000	]	Ts30	:	[	0000	]	Ts31	:	[	0000	]

Figure 7-19. Voice Rx Signaling

Voice Tx Signaling Statistics on Slot: 2, Port: 1														
Ts1	:	[	0000	]	Ts2	:	[	0000	]	Ts3	:	[	0000	]
Ts4	:	[	0000	]	Ts5	:	[	0000	]	Ts6	:	[	0000	]
Ts7	:	[	0000	]	Ts8	:	[	0000	]	Ts9	:	[	0000	]
Ts10	:	[	0000	]	Ts11	:	[	0000	]	Ts12	:	[	0000	]
Ts13	:	[	0000	]	Ts14	:	[	0000	]	Ts15	:	[	0000	]
Ts17	:	[	0000	]	Ts18	:	[	0000	]	Ts19	:	[	0000	]
Ts20	:	[	0000	]	Ts21	:	[	0000	]	Ts22	:	[	0000	]
Ts23	:	[	0000	]	Ts24	:	[	0000	]	Ts25	:	[	0000	]
Ts26	:	[	0000	]	Ts27	:	[	0000	]	Ts28	:	[	0000	]
Ts29	:	[	0000	]	Ts30	:	[	0000	]	Ts31	:	[	0000	]

Figure 7-20. Voice Tx Signaling

## Calculating the E1/T1 Group CPU Utilization Statistics

When calculating the CPU utilization, Vmux-2100 displays the following values:

- Current CPU utilization
- Maximum utilization of the CPU resources ever registered by the management software.

➤ **To calculate the E1/T1 group CPU utilization:**

1. From the Cards Statistics menu, choose **CPU utilization**.
2. From the Cpu Utilization menu, choose **Slot>** and then enter the desired slot number from the displayed list to select the slot.
3. From the Cpu Utilization menu, choose **Group Number>** and then enter the desired group number from the displayed list to select the group.
4. From the Cpu Utilization menu, choose **Display** to display the statistics.

```
Slot 2, Group 1: Cpu Statistics
CPU Utilization  :[ 17      ]   Max:[ 26      ]

@ - Db Update; # - Db Undo
ESC-prev.menu; !-main menu; &-exit
```

*Figure 7-21. E1/T1 Group CPU Utilization Statistics*

# Appendix A

## Interface Connector Specifications

### A.1 E1/T1 Ports

#### Balanced E1/T1 Interface Connector

The balanced E1/T1 interfaces of the main link and voice modules terminate in RJ-45 connectors. [Figure A-1](#) illustrates location of the pins in the E1/T1 balanced connector. [Table A-1](#) lists the E1/T1 connector pin assignment.

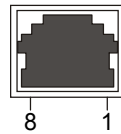


Figure A-1. RJ-45 Connector Pin Location

Table A-1. E1/T1 Balanced Connector Pinout

Pin	Function
1, 2	Receive (input)
4, 5	Transmit (output)

### A.2 Ethernet Interface Connector

The 10/100BaseT main link interface terminates in a RJ-45 connector. [Table A-2](#) lists the Ethernet connector pin assignment.

Table A-2. Ethernet Connector Pinout

Pin	Signal	Function
1	TD (+)	Transmit Data (positive)
2	TD (-)	Transmit Data (negative)
3	RD (+)	Receive Data (positive)
6	RD (-)	Receive Data (negative)

**Note**

Ethernet main link port supports connection via straight and cross cables.

### A.3 CONTROL Connector

The control terminal interface terminates in a V.24/RS-232 9-pin D-type female DCE connector. [Table A-3](#) lists the CONTROL connector pin assignments.

Table A-3. CONTROL Connector Pinout

Pin	Function	Direction
1	Data Carrier Detect (DCD)	Out
2	Receive Data (RD)	In
3	Transmit Data (TD)	Out
4	Data Terminal Ready (DTR)	In
5	Ground (GND)	–
6	Data Set Ready (DSR)	Out
7	Request To Send (RTS)	In
8	Clear To Send (CTS)	Out
9	NC	–

**Note** When connected and turned on, the terminal sets the DTR line ON (active) to gain control over Vmux-2100 and starts a configuration or monitoring session.

### A.4 CBL-VMUX-MM-MODEM Cross Cable

When connecting the Vmux-2100 CONTROL port to an ASCII terminal via a modem link, you must use the CBL-VMUX-MM-MODEM cross cable, which can be ordered from RAD.

CBL-VMUX-MM-MODEM cross cable includes two male DB-9 connectors, designated MODEM and VMUX. [Figure A-2](#) illustrates the cross cable. [Table A-4](#) describes the cross cable wiring.



Figure A-2. CBL-VMUX-MM-MODEM Cross Cable

*Table A-4. CBL-VMUX-MM-MODEM Cross Cable Wiring*

<b>MODEM Connector Pin</b>	<b>VMUX Connector Pin</b>
2	3
3	2
1	7
7	1
4	6
9	4
5	5





# Appendix B

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## Boot Manager and Software Downloading

---

### B.1 Introduction

This chapter describes the Vmux-2100 boot software and provides instructions for software downloading via XMODEM or TFTP applications.

The Vmux-2100 software is stored in the Flash memory in two sections: boot and file system. The boot sector holds a boot program that calls up the rest of the program from the files system.

The file system can hold two compressed copies of the Vmux-2100 application software. One copy is referred to as **active partition** (usually partition 1), the other – as **backup partition** (usually partition 0). The active partition is decompressed and loaded into the Vmux-2100 RAM upon power-up. The backup file is used whenever the active file is missing or corrupted.

---

### B.2 Booting Vmux-2100

Vmux-2100 boots up automatically. After power-up, no user intervention is required, except when the user wants to access the file system to modify or update the Vmux-2100 application software.

#### Boot Sequence

The following is a description of the boot sequence. If the system is working normally, the entire process is completed within two minutes.

1. The boot program searches for the active partition in the file system. If the file exists, the program continues.

If the file does not exist, the boot program searches for the backup file. If the backup is found, it is used instead of the active partition, and the boot process continues.

If there is no backup file, you must download a file via the XMODEM protocol. The received file is saved as the active file in the file system.

2. Active and backup partitions are compressed and automatically decompressed into the RAM before execution begins.
3. After decompression, the Vmux-2100 software starts to execute and the user can begin working.

## Accessing the File System

The file system menu is an option that allows the user to perform basic file transfer operations. These operations are all optional.

When working with the File System menu, configure the ASCII terminal rate to 115.2 kbps.

► **To access the File System menu:**

- Press **<Enter>** several times immediately after powering up the Vmux-2100.

The File System menu is displayed (see [Figure B-1](#)).

```
RAD VMUX Boot Version 1.20 (Jun 16 2002)
RAD Boot Manager Version 3.30 (Jun 16 2002)

0 - Exit Boot-Manager
1 - Show partitions information
2 - Set the active partition
3 - Erase a partition
4 - Download an application by XMODEM
5 - Select an application to run temporarily
6 - Erase all partitions
7 - Show basic hardware information

Select:
```

*Figure B-1. File System Menu*

From the File System menu, you can:

- Show the partition information.
- Set the active partition.
- Erase a partition.
- Download an application via XMODEM application (see the [Downloading Application Files via XMODEM](#) section).
- Select a partition for a temporary (one-time) use.
- Erase all partitions.
- Display the basic hardware information (RAM, ROM size etc).

**Notes**

- Partition information displayed via the File System menu, does not include the application software of the voice modules. Use the 'Show Partition Information' menu (**Main Menu > Configuration > System > Show Partition Information**) to display complete information on the Vmux-2100 application software.
- You can also exchange the active and backup partitions via the 'Set the Active Application' menu (**Main Menu > Configuration > System > Set the Active Application**).

---

## B.3 Downloading the Application and Configuration Software

New application software releases are distributed as **\*.img** files, which are downloaded to Vmux-2100 using the XMODEM protocol from the File System menu of the boot software. Alternatively, you can download a new software release via TFTP protocol, when the Vmux-2100 management software is already running.

The TFTP protocol can also be used for uploading configuration files which contain the Vmux-2100 database to the management station. Administrators can use this capability to distribute verified configuration files to all other units which use the similar configuration.

### Downloading Application Files via XMODEM

Downloading application files using the XMODEM protocol is performed from the File System menu of the boot software.

➤ **To download application file via XMODEM:**

1. Configure your ASCII terminal or terminal emulation utility running on your PC to the 115.2 kbps data rate.
2. Access the File System menu (see the [Accessing the File System](#) section above).  
The File System menu appears (see [Figure B-1](#)).

3. From the File System menu, type **4**.

Vmux-2100 displays the following message:

**Select partition to download**

4. Select the backup partition by typing its number, **1**.

Vmux-2100 requires confirmation of the partition deletion:

**The partition is full. Do you want to erase it (y/n)**

5. Type **Y**.

Vmux-2100 responds with the following string:

**Please start the XMODEM download.**

6. Send the **\*.img** file to Vmux-2100 using the XMODEM utility of your terminal application.

Once the downloading is completed, Vmux-2100 saves the new release as an active partition, the former active partition turns into backup, and the boot sequence continues normally.

If a failure occurs during the download, the partially downloaded software is erased. In this case, only active software is left in the Flash memory.

---

**Note** *After the software upgrade has been performed, it will take several minutes for the Vmux-2100 to begin operating again. This delay is due to the time the main module requires to update all the voice modules.*

---

## Downloading Application Files via TFTP

The application software is downloaded when Vmux-2100 has been already completed the boot-up procedure and the management software is running.

➤ **To download application file via TFTP:**

1. Start a TFTP application.
2. Configure the communication parameters as follows:
  - Connection timeout – more than 30 seconds to prevent an automatic disconnection during the backup partition deletion (about 25 seconds).
  - Block size – 512 bytes.
  - UDP port – 69.
3. Select a local \*.img file to download.
4. Set remote file name to **vmux.img**.
5. Enter the Vmux-2100 IP address.
6. Start downloading.

Vmux-2100 automatically erases the backup partition (it takes about 25 seconds). Once the downloading is completed, Vmux-2100 saves the new release as an active partition, the former active partition turns into backup.

7. Restart the unit.

---

**Note** *After the software upgrade has been performed, it will take several minutes for the Vmux-2100 to begin operating again. This delay is due to the time the main module requires to update all the voice modules.*

---

## Uploading/Downloading Configuration Files via TFTP

You can upload a Vmux-2100 configuration file (**cnfg.dat**) to the management station for further distribution to all other units which use the similar configuration.

➤ **To upload application file via TFTP:**

1. Start a TFTP application.
2. Set remote file name to **cnfg.dat**.
3. Enter the Vmux-2100 IP address.
4. Start uploading.

When the uploading is completed, you can download the **cnfg.dat** file to other Vmux-2100 units. After the downloading, make sure to update the new database software by typing @.

---

**Note** *The system and the main link values do not change when you download the new configuration and update the database.*

---

# Appendix C

## Configuration Menus

This appendix lists all menus of the Vmux-2100 management software.

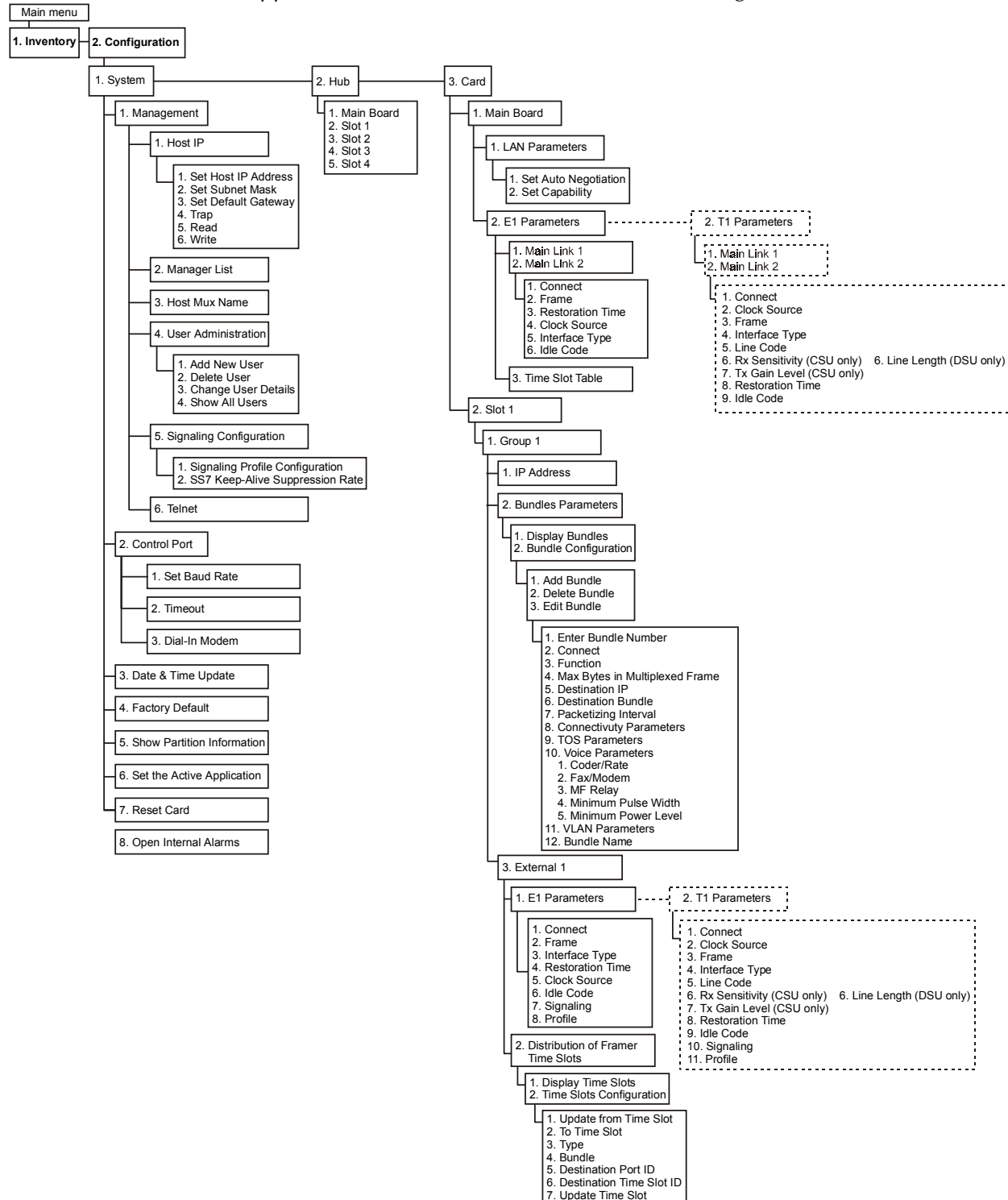


Figure C-1. Inventory and Configuration Menus

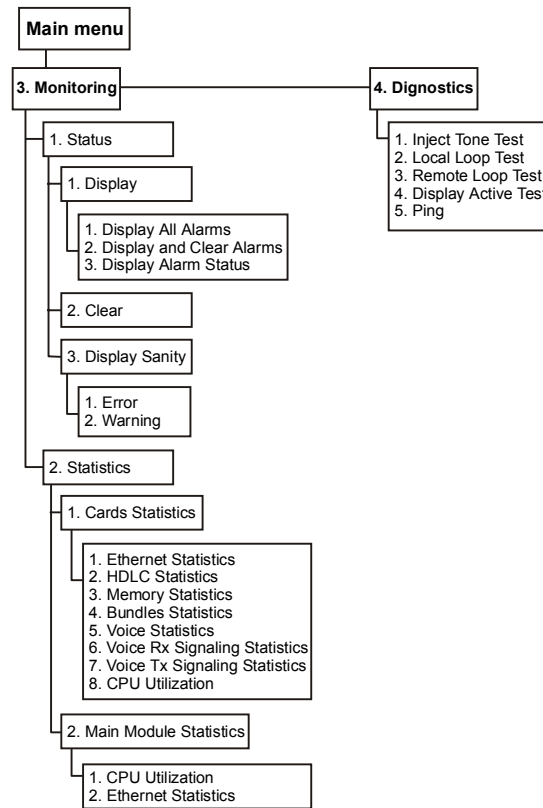


Figure C-2. Statistics and Diagnostics Menus